ANATOMICO-CLINICAL STUDY OF INVOLUNTARY MOVEMENTS (CHAL-MURDHATA LAKSHANA) W.S.R. HEAD AND ITS RELATION WITH KRUKATIKA MARMA

A Thesis

SUBMITTED TO THE

TILAK MAHARASHTRA VIDYAPEETH, PUNE

FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

In

AYURVEDA-SHARIR RACHANA

Under the Board of Ayurveda Studies

Estd. 1921

BY

ROKADE SURYAKANT DATTATRAYA

PRN05614007207/PhD Ayurveda/2014-15

UNDER THE GUIDANCE OF

Dr. CHANDRASHEKHAR DATTATRAYA VAIKOS

DEPARTMENT OF AYURVEDA

2022

CERTIFICATE OF SUPERVISOR

It is certified that work entitled **Anatomico-Clinical Study Of Involuntary Movements (Chal-Murdhata Lakshana) W.S.R. Head And Its Relation With Krukatika Marma** is an original research work done by **Dr. Rokade S.D.** under my supervision for the degree of Doctor of philosophy in **Ayurveda** to be awarded by Tilak Maharashtra Vidyapeeth, Pune. To best of my knowledge this thesis:

- Embodies the work of candidate himself
- Has duly been completed
- Fulfils the requirements of the ordinance related to Ph.D degree of the TMV
- Up to the standard in respect of both content and language for being referred to the examiner.

Dr. Chandrashekhar D. Vaikos **Signature of the supervisor**
Professor,

Dept of Rachana Sharir,

Government Ayurved Mahavidyalaya,

Nanded.

Mob.9422871600

Tilak Maharashtra Vidyapeeth, Pune

Undertaking

I, **Dr. Rokade S. D.** is the Ph. D Scholar of the Tilak Maharashtra Vidyapeeth, Pune in Ayurveda. Thesis entitled **Anatomico-Clinical Study Of Involuntary Movements (Chal-Murdhata Lakshana) W.S.R. Head And Its Relation With Krukatika Marma** under the supervision of **Dr. Chandrashekhar Dattatraya Vaikos**. Solemnly affirm that the thesis submitted by me is my own work. I have not copied it from any sources. I have gone through extensive review of literature of the related published /unpublished research work and the use of such references made has been acknowledged in my thesis. The title and the content of research is original. I understand that, in case of any complaint especially plagiarism, regarding my Ph. D. research from any party, I have to go through the enquiry procedure as decided by Vidyapeeth at any point of time. I understand that, if my Ph. D. thesis (or part of it) is found duplicate at any point of time, my research degree will be withdrawn and in such circumstances, I will be solely responsible and liable for any consequences arises thereby. I will not hold the TMV, Pune responsible and liable in any case.

I have signed the above undertaking after reading carefully and knowing all the aspects therein.

Signature:

Address: Professor and HOD, Dept. of Rachana Sharir, Government Ayurved Mahavidyalaya, Nanded. (Maharashtra) PIN- 431601

Mob. No. 9860054747 **email:** suryakantrokade@yahoo.in

Date: / /2022 **Place:** Nanded (Maharashtra)

ACKNOWLEDGEMENTS

I have a great pleasure to let out my

deep rooted sense of gratitude to

Dr. Chandrashekhar Dattatraya Vaikos

MD Ph.D.

Hon.Professor,Dept of Rachana Sharir (Government Ayurved mahavidyalaya, Nanded)

For guidance and encouragement .

It is my prime duty to express

My sincere gratitude to

Prof.(Dr.) Abhijit Joshi

MD, PhD

Registrar

HOD, Dept. of Ayurveda

Tilak Maharashtra Vidyapeeth, Pune

&

Prof.(Dr.) Y.R. Patil

MD(Swasthavrutta), PhD (Swasthavrutta)

Dean, Government Ayurved Mahavidyalaya, Nanded.

&

Dr. Prashant Gopinath Sali

MD (Sharir Rachana), PhD (Rachana Sharir)

Assistant Professor, Dept. Of Rachana Sharir,

Government Ayurved Mahavidyalaya, Nanded.

For their moral support and encouragement

My sincere thanks to

My wife

Dr. Vaishali S. Rokade

Who was always a source of encouragement

And help in all aspects of the work

My children

Dr. Aishwarya S. Rokade & Dr. Samruddhi S. Rokade

My students

Dr. Priyanka Raut, Dr. Vikas Kashikar, Dr.Soumya singh,

Dr. Priyanka Nirwal, Dr. Aishwarya Bhosale, Dr. Vishnukant Jadhav

Dr. Shital Swami, Dr.Sruthi K, Dr. Dhairyashil Patil

TMV Ayurved department staff

Dr. Manoja Abhijit Joshi & Mrs. Pathak

Index

SUMMARY

The thesis entitled "**Anatomico-Clinical Study of Involuntary Movements (*Chal Murdhata Lakshana*) WSR head & its relation with Krukatika Marma"** comprises of section viz. of Introduction, Aim and Objectives, Review of literature, material and methods, Observation and Result, Discussion, Summary and Conclusion.

The first section termed as **Introduction** in this section importance of *Ayurveda, Sharira, Sandhi, and Krukatika marma* introduces. General description about *Krukatika marma* and *Chal Murdhata* mentioned.

Second section is **Aim and Objective:-**

AIM:

Anatomical study of *Krukatika marma* and its *viddha lakshna Chalmurdhta* w.s.r.to involuntary movements of head.

OBJECTIVE:

1. To study of Involuntary Movements (*Chal Murdhata Lakshana*) WSR head as *Krukatika Marma Vidhya Lakshana & other Lakshanani*.
2. To study the cervical vertebral column changes in Involuntary Movements (*Chal Murdhata Lakshana)* WSR head.
3. To study the *rachana* sharer of *krukatika marma*.
4. To evaluate the relation between involuntary movements of head and *krukatika marma*.

The third section **Review of literature**, it has been dealt with fallowing headings,

Ayurvedic review of literature:-

In this section the concepts of *Sandhi, marma*, classification of *marma* according to different *samhitas* have been described. There after an attempt has been made to describe the *Vaikalyakar marma, Krukatika marma and its Viddha lakshana.*

Modern review of Literature:-

In this part concept of vertebral column anatomy of cervical region vertebrae and intervertebral disc described in details. Also concept of cranio-vertebral joint, involuntary movements, differential diagnosis of involuntary movements, etiological factors, risk factors, sign and symptoms, pathophysiology, differential diagnosis and treatment were discussed.

In differential diagnosis following disease are discussed-

1. Parkinson's disease
2. Spinocerebral ataxia cervical dystonia.
3. Huntington's disease.
4. Essential Tremors.
5. Chorea.
6. Tardive dystonia
7. Tourette syndrome.

The fourth section termed as **Material and methods** comprises of description on how the study has been carried out. It described in two stages- Conceptual study, and clinical study. For conceptual study various texts have been referred related to both *Ayurvedic* as well as modern literature. For the observational study based on clinical observations, patients were given an idea of the study and informed consent was taken prior to the study.

Patients suffering from involuntary movements of head were studied and findings recorded duly in the case record from designed for the study.

The Fifth section **Observation and result.** Here describes the observations on clinical study of patients with involuntary movements. The observations are analyzed by means of statistics and inferences are drawn accordingly. The results obtained by the study have been elaborated.

The sixth section is **Discussion**. The total output of the study by means of literature and clinical study has been discussed in details.

The seventh section of the dissertation is **Summary**. It summarizes the entire work in shortest possible way.

Conclusion is the eighth section and in this, entire work has been concluded. Conclusions are drawn based on observations and data analysis.

INTRODUCTION

Ayurvedic knowledge Originated in India more than 5,000 years ago and often called the, 'Mother of all Healing. [(1)] *Ayurveda*, the Indian system of medicine incorporates the unique concept of healthy body and healthy mind. *Ayurveda* is an intricate system of healing that originated in India thousands of years ago. The purpose of *Ayurveda* is maintenance of health of an individual and to cure the diseased person.

"इह खल्वायुर्वेदप्रयोजनं– व्याध्युपसृष्टानां व्याधिपरिमोक्षः स्वस्थस्य रक्षणञ्च ।"

(सु.सु.१/२२)

'Ayurveda' the science of life deals with every aspect of life. [(2)] Life according to *Ayurveda* is a combination of senses, mind, body and soul. The perfect balance of mind, body and soul is considered as complete health in *Ayurveda.*

"धातुसाम्यक्रिया प्रोक्ता तन्त्रस्यास्य प्रयोजनम्।"

(च.सु.१/)

Most of part of Anatomy *(Rachana*) described in *Sharirsthana* in all *Bruhtrayees*. *Acharyas* gives details knowledge about *sharira* in different *Samhitas.*

Principles of *Ayurveda* which are mingled with basic concept of life have significant value even in the life of modern era. It emphasizes the importance of preventive medicine along with curative procedure to give a holistic approach towards a healthy living. The science of *marma* is another extraordinary and dynamic *Ayurvediic* therapy.

Among many unique concepts, the contribution of *Ayurveda*, with special reference to *Sushruta Samhita* towards ***'Marma Shareera'*** or 'science of vital points and delicate structure of the body' is immense. [(3)]

Marmas is the vital part of *Shareerarachana. Marma* is critical element in human body. *Marma* is a *Sanskrit* word meaning hidden or secrete. A *marma* point is a juncture on the body where two or more type of tissue meat, such as muscles, veins, ligaments, bones or joints. Although *Marma* points are much more than a casual connection of tissue and fluids, they are points of the vital life force. [(4)]

Many different *marma* points have been described in the Ayurvedic texts (literatures) along with their specific effects. Point based therapies, such as acupuncture, acupressure and reflexology, are believed to have been derived from the science of *marma*. The *marma* (vital points) are a very important and unique part of *Ayurvedic* anatomy and surgery.

"मारयन्ति इति मर्माणि ।"

(सु.सु.६/३, डल्हान टिका)

Marma is the part of body, if injury happens to *Marma* it results into death or fetal complications hence called as *Marma.*

"मर्माणि नाम मासं सिरा स्नायु अस्थि संधि सन्निपाता: ।
तेषु स्वभावत एव विशेषेण प्राणा: तिष्ठन्ति ॥
तस्मान्मर्मसु अभिहता: तांस्तान् भावान् आपध्यते ॥"

(सु.शा. ६/२२)

It's an anatomical site where five structures i.e., *Mamsa* (Muscles), *Sira* (Vessels), *Snayu* (Ligaments), *Asthi* (Bones), and *Sandhi* (Joints) fusion at one point.

Description of *marma* is available in both *laghutrayi* and *bruhattrayi* with relation to their number, sites, classification and clinical correlation. Their number as per various texts is 107.

"मर्म संख्यासप्तोत्तरं मर्म ।
तानि मर्माणि पंचात्मकानिभवन्ति ॥"

(सु.शा ६/२)

Ayurveda describes *marma* as a separate entity. The *marmas* are a very important as there is likelihood of death or serious damage after infliction to these places. It considered by *Aacharya Sushruta* to be an important part of surgery.

"विषमं स्पन्दनं यन्त्र पीडिते रुक च मर्म तत् ।"

(अ.ह.शा ४/३)

Vagbhat is of the view that points which show irregular pulsation and where pain on pressure persists can be labeled as *marmasthan*. *Vagbhat* considered *dhamani marma* in excess to the five types proposed in other *ayurvedic* texts.

Ayurved believes that to be a good physician and a surgeon one has to practically observe and theoretically learn about human anatomy.

"म्रियते अस्मिन अंगे उपहते इति मर्म ।"

(अरुणदत्त टिका अ.ह.शा.४)

According to *Sushruta, marma* is a conglomeration of anatomical structures namely (muscles), *sira* (blood vessels), *snayu* (ligaments and nerves), *asthi* (bone) and *sandhi* (joints).

" तान्येतानि पञ्चविकल्पानि मर्माणि भवन्ति ।
तद्यथा सद्यःप्राणहराणि, कालान्तरप्राणहराणि ,
विशल्यघ्नानि, वैकल्यकराणि, रुजाकराणि चेति।"

(सु.शा ६/१४,घानेकर टिका)

These *marmas* are divided into five categories depending upon the ultimate results (prognosis) after the trauma inflicted upon these points as *Sadhya pranhara marma*, *Kalantara pranhara marma, Vishalyghna marma, vaiklyakara marma, Rujakara marma.*[5]

Of them, emergently fatal *marmas* are igneous and as qualities are extinguished quickly the patients dies immediately; those after a period of time are both watery and igneous and as such even the qualities of agni are extinguished quickly, those of soma disappear gradually leading to death after aperiod of time; *marmas* fatal after extraction of foreign body are predominant in vayu, as long as vayu stays inside obstructed by the tip of splinter the persons lives but as soon as it is extracted vayu positioned at the site of the *marma* comes out, that is why the patient survives till the splinter is there and after extraction he dies.(Or if the foreign body comes out after suppuration, then also

survives); *marmas* causing disability are watery, soma (water) due to firmness and coldness, sustains life.

Sadya-Pranahara group of *marma*s are possessed of *agneya* (thermogenetic) virtues, as these virtues are enfeebled easily. They prove fatal to life if they get injured due to any event.

The *Kalantara- Pranahara marmas* are possessed of *agneya* and *soumya* properties. As the fiery virtues are enfeebled easily and the cooling virtues take a considerable time, these *marma*s prove fatal in the long run.

The *Vishalyaghna Marmas* are possessed of *Vataja* Properties. As long as the dart does not allow the *Vayu* to escape from their injured area, the life prolongs but as soon as the dart is extricated, the *vayu* escapes from the injured area and proves to be fatal.

The *Rujakara Marmas* have *vataja* and *agneya* properties. As both *agni* and *vayu* have pain-generating properties, injury to these *marma*s cause extreme pain. If these *marma*s are mishandled apart from producing severe pain, they can lead to deformity.

There are 44 *vaiklyakara marmas* .

“ लोहिताक्षाणि जानूर्वीकूर्चविटपकूर्पराः।
कुकुन्दरे कक्षधरे विधुरे सकृकाटिके॥
अंसांसफलकापाङ्गा नीले मन्ये फणे तथा।
वैकल्यकरणान्याहुरावर्तौ द्वौ तथैव च ।”

(सु.शा. ६/१९,घानेकर टिका)

If there is any trauma or injury at these points, it causes lifelong abnormality these have predominance of *som mhabhoota* in these.

“ वैकल्यकराणि सौम्यानि, सोमो हि स्थिरत्वच्छैत्याच्च प्राणावलम्बनं करोति।”

(सु.शा.६/२३, घानेकर टिका)

Aacharya Sushruta has described the *krukatika marma* is a *vaikalyakara marma* and its location is as fallows.

LOCATION:

" शिरोग्रीवयो: सन्धाने कृकाटिके नाम, तत्र चलमुर्धता ॥"

(सु.शा.६/३६, घानेकर टिका)

At the joint place of *shira* (Head) and *Greeva* (neck) the *marma* said to be *Krukatika marma* and symptoms of *aaghata* over *Krukatika marma* is:

1. *Chalmurdhta* (involuntary movments).

According to Sushruta size of *Krukatika marma* is stated ½ *anguli pramana.* [(6)]

The study is to analyze the *viddha lakshana* of *krukatika marma* with help of modern anatomy and to revel that *krukatika marma* is associated more with *vaikalykara* property and if proved so out of these five constituting anatomical structures, which structure in this *marma* is mainly involved in its *vaikalyakaratwa* property.

Thus, this dissertation will serve as a bridge to link the gap between the *marma* postulated by *ayurvedic* texts and the modern medical science.

AIM AND OBJECTIVES

AIM:

Anatomical study of *Krukatika marma* and its *viddha lakshna Chalmurdhta* w.s.r.to involuntary movements of head.

OBJECTIVES:

1. To study of Involuntary Movements (*Chal-Murdhataa Lakshana*) WSR head as *Krukatika Marma Vidhya Lakshana* & other *Lakshanani*.
2. To study the cervical vertebral column changes in Involuntary Movements (*Chal-Murdhataa Lakshana*) WSR head.
3. To study the *rachana* sharer of *krukatika marma*.
4. To evaluate the relation between involuntary movements of head and *krukatika marma*.

RESEARCH QUESTION

Is the involuntary movement of head (*chalbadadhta*) having any relation with *krukatika marma.*

HYPOTHESIS

Null hypothesis (H^0): There is no relation between involuntary movments of *krukatika marma.*

Alternative hypothesis (H^A): There is relation between involuntary movements of head and *krukatika marma.*

REVIEW OF *AYURVEDIC* LITERATURE:

1. CONCEPT OF *MARMA*:

The science of life and knowledge is termed as "*Ayurveda*". '*Ayur'* means "life" and '*Veda'* means "science or knowledge". In *Ayurvedic* texts, brief descriptions of body and its anatomical structures are mentioned. The system gives importance more to the preventive aspect than curative aspect. It is an intricate medical system developed in India thousand years ago. To protect health, to prolong life and to eliminate diseases of the body is the aim of this system.

Various concepts are described in *Ayurveda* to achieve greater harmony, peace and longevity, of which concept of *marma* is a distinguishing entity. *Marma*s are the vital centers or subtle energy fields on the body. Its importance is so much that ancient Indian surgeon *sushruta* developed this *marma* system for helping a surgeon to safely operate on the human body. Acupressure, Acupuncture and reflexology therapies have the basis of *marma* which are gaining value in today's era. These vital centers are used as a curative method in various diseases.

Definition:

"मारयन्ति इति मर्माणि ।" [7]

(सु.शा.६/३, डल्हण टीका)

The word *Marma* is of *Sanskrit* origin 'Mrin Maranae'. The *Sanskrit* phrase, *"mriyate asmin iti marma*" means there is likelihood of death or serious damage to health when these points are inflicted. [8]

"मर्माणि मांससिरास्नाय्वस्थिसन्धिसन्निपाता
तेषु स्वभावत एव विशेषेण प्राणास्तिष्ठन्ति ।
तस्मान्मर्मस्वभिहतास्तांस्तान् भावानापद्यन्ते ॥"

(सु.शा.६/१६, डल्हण टीका)

In *Ayurveda*, it is a point in the human body that's located at the intersections of veins, muscles, joints, bones, ligaments or tendons. These points are considered to be vital points because they are infused with *prana* (life force energy) and are influenced by consciousness. (9)

"सन्निपातः सिरास्नायु सन्धिमांसास्थिसम्भवः ।
मर्माणि तेषु तिष्ठन्ति प्राणाः खलु विशेषत ॥" (10)

(भा. प्र. प्र. ख.३/२२३)

"विषमं स्पन्दनं यत्र पीडिते रुक् च मर्म तत्॥"

(अ.ह्र.शा.४/३७)

"मांसास्थिस्नायुधमनीसिरासन्धिसमागमः।
स्यान्मर्मेति च तेनात्र सुतरां जीवितं स्थितम्॥"

(अ.ह्र.शा.४/३८)

मर्माभिघातः स्वल्पो अपि प्रायशो बाधतेतराम् ।
रोगा मर्माश्रयास्तद्वत्प्रक्रान्ता यन्ततो अपि च ॥

(अ.ह्र.शा.४/७०)

In the *Sanskrit* commentary to *Ashtangahrdaya*, titled '*Sarvangasundara*' by *Arundatta* the word *marma* is derived etymologically as that place when affected (severely) causes death. (11)

"अपि च मरणकारित्वान्मर्म,
मरणसदृशदुःखदायित्वाद्वा।"

(अं.ह्र. शा. ४/३७)

"मर्माणि जीवधाराणि प्रायेण मुनयो जगुः ॥" (12)

(शा. सं. पू. ५/३९).

Acharya Sharangdhara says that, *Marma* are the intersections of veins, muscles, joints, bones, ligaments or tendons. These points are considered to be vital points because they are the places of *Prana*.

Acharya Sushruta told that *Marmas* are the place where *Upadan karan* of *sharira* i. e. *Som, Marut, tej* and *Triguna (Satwa, Raja, Tama)* are situated. So that when *marma* get affected (severely) it causes death. Therefore, *marma* are called as '*JIVANAADHAR'*.

Marma is that site of the body which leads to fatality when it gets injured. Any trauma to the *marma* point leads to miseries equivalent to death. *Marma* points are basically sites of *prana*. These are the points where irregular pulsations and pain is felt when pressure is applied or trauma. Pain sensation is more at the site of *marma*, compared to other parts of the body, as *chetna* is situated in the *marma*sthana.

Marma is the site at which five anatomical structures such as *Mamsa*, *Asthi*, *Snayu*, *Dhamani*, *Sira* are involved which are essential in the formation of these vital centres. According to *Acharya Vagbhata* points where irregular pulsations and severe pain is felt when pressure is applied are known as *marma*sthanas. According to *Dalhana* the vital points are those points on the human body on which any kind of trauma or injury may lead to disability or death.

"सप्तोत्तरं मर्मशतमस्मिञ्छरीरे स्कन्धशाखासमाश्रितमाग्निवेश ।
तेषामन्यतमपीडायां समधिका पीडा भवति;
चेतना निबन्धवैशेष्यात् ॥

(च. सि. ९/३)

"तत्पुनर्मांससिरास्नाय्वास्थिसन्धिसन्निपातः
तेन् तस्मिन् पीड्यमाने विशेषतः प्राणाबाधः।
बाहुल्येन तु निर्देशः
तस्मान्मांसाद्याश्रयतो मर्माणि पञ्चधा भिद्यन्ते ॥"

(अ. सं. शा.७/४९)

Krikatika Marma
A Type Of Sandhi Marma &
Vaikalyakara Marma

CLASSIFICATION OF *MARMA*:

For better understanding, the *Marma* are divided into different groups on the basis of physical properties and also on the basis of their special features.

All the *Acharyas* have accepted the number to be 107. There is no contraindication in the number of *marma*s. According to *Acharya Sushruta*, *Acharya Charaka* and *Acharya Vagbhata*, *marma*s are 107 in number.

***Charak Samhita*:**

"सप्तोत्तरं मर्मशतं यदुक्तं शरिरसंख्यामधिकृत्य तेभ्य:
मर्माणि बस्ति हृदयं शिरश्च प्रधानभूतानि वदन्ति तज्ज्ञा:
प्राणाश्रयात, तानि हि पीडयन्तो वातादयोऽसूनपि पीडयन्ति ।"

(च. चि.२६/३,४)

Acharya Charaka mentioned 107 *marma*s but he emphasized on three *marma*s i. e. *Basti*, *Hridaya*, and *Shira* which are together known as "*Trimarma*". Infliction to these points leads to fatality like death, as these are the vital centers of life. *Trimarma* are explained in the *trimarmiya adhyaya* of *Chikitsa Sthana*. *Basti*, *Hridaya*, *Shira* is respectively the place of *vata*, *pitta* and *kapha*. Vitiated *Doshas* when reach these *marma sthanas* produce *maharog* i. e. Fatal diseases.

"सप्तोत्तरं मर्मशतमस्मिश्छरीरे स्कन्धशाखासमाश्रितमाग्निवेश ।
तेषामन्यतमपीडायां समधिका पीडा भवति; चेतना निबन्धवैशेष्यात् ॥
तत्र शाखाश्रितेभ्यो मर्मभ्यः स्कन्धाश्रितानि गरीयांसि, शाखानां तदाश्रितत्वात्;
स्कन्धाश्रितेभ्यो मर्मभ्यः स्कन्धाश्रितानि गरीयांसि, शाखानां तदाश्रितत्वात्;
स्कन्धाश्रितेभ्योऽपि ह्रद्वस्तिशिरांसि, तन्मूलत्वाच्छरीरस्य ॥

(च. सि. ९/३)

"तत्र एकादश मासंमर्माणि एकचत्वारिंशतसिरामर्माणि सप्तविशंति स्नायुमर्माणि,
अष्टावस्थिमर्माणि, विंशतिः सन्धिमर्माणि चेति।
तदेतत् सप्तोत्तरं मर्मशतम् ॥

(सु.शा.६/३)

Muscular marmas are eleven, vascular marmas fourty one, ligamental marmas twentyseven, bony marmas eight and twenty marmas in joints. Thus, there are one hundred and sevsn marmas. (13)

Ashtang Hridaya:

"मांसजानि दश, अस्थ्यष्टौ, स्नावमर्माणित्रयोविंशतिराणयः, नवादिशेत् मर्माणि
धमनिस्थानि, सप्तत्रिंशत्सिराश्रयाः सन्धौ विंशतिः ॥"

(अ.ह्र.शा ४/४०–४४)

Acharya vagbhata also states 107 *marma*s according to *Sushruta* and *Charaka* but the distribution of these *marma*s is on the basis of structure. But he explained

Dhamani marma in addition to the above five categories mentioned by *Sushruta*, thus categorizing *marma*s into six major heads.

Table 1: *Marma* classification as per *Rachnatmaka* aspect (*Sushruta/Vagbhata*)

1.) *Siramarma*:

"नीलाधमनीमात्काश्रृङ्गाटकापाङ्गस्थपनीफणस्तनमूलापलापापस्तम्भहृदयनाभिपार्श्वसन्धिबृहती लोहिताक्षोर्व्वः शिरार्ममाणि ।"

(सु.शा.६/७)

Sr.No.	Sushruta	No.	Vagbhata	No.
1.	Manya	2	Manya	2
2.	Neela	2	Neela	2
3.	Matruka	8	Matruka	8
4.	Hridaya	1	Hridaya	1
5.	Apalapa	2	Apalapa	2
6.	Stanamoola	2	Stanamoola	2
7.	Phana	2	Phana	2
8.	Sthapani	1	Sthapani	1
9.	Nabhi	1	Nabhi	1
10.	Parshwasandhi	2	Bruhati	2
11.	Bruhati	2	Parshwasandhi	2
12.	Sringataka	4	Lohitaksha	4
13.	Urvi	4	Urvi	4
14.	Lohitaksha	4	Kakshadhara	2
15.	Apanga	2	Vitapa	2
16.	Apastambha	2		
Total	41	Total	37	

2.) ***Mansamarma*:**

"तत्र तलहृदयेइन्द्रबस्ति–गुद–स्तनरोहितानि मांसमर्माणि ।"

(सु.शा.६/७)

Sr. No.	**Sushruta**	**No.**	**Vagbhata**	**No.**
1.	Indrabasti	4	Indrabasti	4
2.	Talahridaya	4	Talahridaya	4
3.	Stanarohita	2	Stanarohita	2
4.	Guda	1	Guda	1
Total		11		11

3.) ***Snayumarma*:**

"आणि–विटप–कक्षधर–कूर्चशिरो–बस्ति–क्षिप्रांसविधूरोत्क्षेपा: कूर्चमर्माणि ।"

(सु.शा.६/८)

Sr. No.	**Sushruta**	**No.**	**Vagbhata**	**No.**
1.	Kurchashira	4	Ani	4
2.	Kurcha	4	Kurchashira	4
3.	Ani	4	Kurcha	4
4.	Kshipra	4	Kshipra	4
5.	Amsa	2	Apanga	2
6.	Basti	1	Basti	1
7.	Kakshadhara	2	Utkshepa	2
8.	Vitapa	2	Amsa	2
9.	Vidhura	2		
10.	Utkshepa	2		
Total	27	Total	23	

4.) Sandhimarma:

"जानु –कूर्पर–सीमन्ता–धिपति–गुल्फ–मणिबन्ध–कुकुन्दरा–वर्त–कृकाटिकाश्चेति सन्धिमर्माणि ।"

(सु.शा.६/७)

Sr.No	Sushruta	**No.**	Vagbhata	**No.**
1.	Kurpara	2	Kurpara	2
2.	Janu	2	Janu	2
3.	Seemanta	5	Seemantha	5
4.	Adhipati	1	Adhipati	1
5.	Kukundara	2	Manibandha	2
6.	Manibandha	2	Gulpha	2
7.	Gulpha	2	Kukundara	2
8.	Avarta	2	Avarta	2
9.	Krukatika	2	Krukatika	2
Total	20		Total	20

5.) ***Asthimarma***:

"कटिकतरुण–नितम्बां–सफलक–शंखास्तवस्थिमर्माणि ।"

(सु.शा.६/७)

Sr.No.	**Sushruta**	**No.**	**Vagbhata**	**No.**
1.	Ansaphalaka	2	Ansaphalaka	2
2.	Katikatarun	2	Katikatarun	2
3.	Nitamba	2	Nitamba	2
4.	Shankha	2	Shankha	2
5.	Total	8	Total	8

6.) Dhamani marma

" गुदापस्तम्भविधुरश्रृङ्गाटनि नवादिशेत् । मर्माणि धमनीस्थानी, (नव मर्माणि)ा ।"[14]

(अ. ह्र. शा. ४/४२, अरूणदत्त टिका

Table 2: *Marma* classification as per *Parinamatmak* aspect (*Sushruta*)

"तान्येतानि पञ्चविकल्पानि मर्माणि भवन्ति । तद्यथा – सद्यप्राणहराणि कालान्तरप्राणहराणि विशल्यघ्नानि वैकल्यकराणि रूजाकराणि चेति । तत्र सद्य:प्राणहराण्येकानविंशति: कालान्तरप्राणहराणि त्रयस्त्रिंशत त्रीणि विशल्यघ्नानि चतुश्चत्वारिंशद्वैकल्यकराणि अष्टौ रुजाकराणीति ।"

(सु.शा.६/९)

They are further divided into five groups (according to effect) such as- emergently fatal, fatal after a period of time, fatal after extraction of the foreign body, disabling and painful.

Of these, nineteen are emergency fatal, thirtythree are fatal after a period of time, three are fatal after extraction of foreign body, fourtyfour are disabling and eight are painful. [15]

Sr.no.	***Sushruta***	**Number**
1.	*Sadyapranahara*	19
2.	*Kalantarpranhara Marma*	33
3.	*Rujakara Marma*	08
4.	*Vishalyaghna*	03
5.	*Vaikalyakar*	44

" तत्र सध्य: प्राणहराण्याग्नेयानि, अग्निगुणेष्वाशु क्षीणेषु क्षपयन्ति; कालान्तरप्राणहराणि सौम्याग्नेयानि, अग्निगुणेष्वाशु क्षीणेषु क्रमेण च सोमगुणेषु कालान्तरेण क्षपयन्ति; विशल्य प्राणहराणि वायव्यानि, शल्यमुखावरुध्दो यावदन्तर्वायुस्तिष्ठति तावज्जीति, उध्दतमात्रे तु शल्ये मर्मस्थानाश्रितो वायुर्निष्क्रामति, तस्मात्

सशल्यो जीवत्युध्दतशल्यो म्रियते; वैकल्यकराणि सौम्यानि, सोमो हि स्थिरत्वाच्छैत्याच्च प्राणावलम्बवनं करोति: रुजाकराण्यग्निवायुगुणभूयिष्ठानि, विशेषतश्च तौ रुजाकरौ; पाञ्चभौतिकीं च रुजामाहुरेके॥"

(सु.शा.६/१६)

***Marma Parinam* with respect to *Dosha* predominance:**

***Marma* (Prognostic classification)**	***Bhutas***	**Prognosis**
Sadyapranahara	*Agneya*	Sudden death within seven days
Vishalyaghna	*Vayavya*	*Vayu* escapes if *shalya* is extracted and results in death
Vaikalyakara	*Soumya*	*Shaityam* and *Sthiratvam* of *soma guna* result in *pranavlamban* and results in deformity
Rujakara	*Agneya+ vayavya*	Pain
Kalantarapranahara	*Agneya +Soumya*	Death within fourteen days of Injury

Of them, emergently fatal *marmas* are igneous and as qualities are extinguished quickly the patients dies immediately; those after a period of time are both watery and igneous and as such even the qualities of agni are extinguished quickly, those of soma disappear gradually leading to death after aperiod of time; *marmas* fatal after extraction of foreign body are predominant in vayu, as long as vayu stays inside obstructed by the tip of splinter the persons lives but as soon as it is extracted vayu positioned at the site of the *marma* comes out, that is why the patient survives till the splinter is there and after extraction he dies.(Or if the foreign body comes out after suppuration, then also survives); *marmas* causing disability are watery, soma (water) due to firmness and coldness, sustains life;

marma causing pain are predominant in qualities of agni and vayu as they particularly cause pain; some however, say that pain is related to all the five *bhutas*. [(16)]

1.) ***Sadyapranahara Marma*:**

"श्रृङ्गाटकान्यधिपतिः शङ्खौ कण्ठसिरा गुदम् । हृदयं बस्तिनाभि च घ्नति सद्योहतानि तु ।"

(सु.शा.६/१०)

Name of *Marma*	**Number**
Shringataka	4
Adhipati	1
Shankh	2
Kanthasira	8
Guda	1
Hridaya	1
Basti	1
Nabhi	1
Total	19

Sadya-Pranahara group of *marma*s are possessed of *agneya* (thermogenetic) virtues, as these virtues are enfeebled easily. They prove fatal to life if they get injured due to any event.

2.) ***Vaikalyakara Marma*:**

"लोहिताक्षाणि जानुर्वीकूर्चविटपकूर्पराः । कुकुन्दरे कक्षधरे विधुरे सकृकाटिके । अंसांसफलकापाङ्ग नीले मन्ये फणौ तथा । वैकल्यकरणान्याहुरावर्तौ द्वौ तथैव च ॥"

(सु.शा.६/१२–१३)

Name of *Marma*	**Number**
Vitap	2
Vidhura	2
Kurcha	4
Ansa	2
Ani	4
Lohitaksha	4
Apanga	2
Neela	2
Manya	2
Phana	2
Urvi	4
Kurpara	2
Kukundara	2
Janu	2
Krukatika	2
Kakshadhara	2
Avarta	2
Ansaphalaka	2
Total	44

"हते वैकल्यजनने केवलं वैद्यनैपुनाद् ।
शरीरं क्रियया युक्तं विकलत्वमवाप्नुयात् ॥"

(सु.शा.६/४०)

The *Vaikalyakara marmas* are possessed of *soumya* properties; they retain the vital fluid owing to their cooling and steady virtues. Hence, they only lead to deform the organism if they get injured due to any event instead of death. (17)

***3) Rujakara Marma*:**

"गुल्फौ द्वौ मणिबन्धौ द्वे द्वे कूर्चशिरांसि च ।
रुजाकराणि जानीयाद्ष्टावेतानि बुध्दिमान् ॥"

(सु.शा.६/१४)

Name of *Marma*	**Number**
Gulpha	4
Manibandha	2
Kurchasira	2
Total	8

"रुजाकराणि मर्माणि क्षतानि विविधा रुजः ।
कुर्वन्त्यन्ते च वैकल्यं कुवैद्यवशगो यदि ॥" (१८)

(सु.शा.६/४१)

The *Rujakara Marmas* have *vataja* and *agneya* properties. As both *agni* and *vayu* have pain-generating properties, injury to these *marma*s cause extreme pain. If these *marma*s are mishandled apart from producing severe pain, they can lead to deformity.

4.) *Vishalyaghna Marma*:

"उत्क्षेपौ स्थपनी चैव विशल्यघ्नानि निर्दिशेत् ॥"

(सु.शा.६/११)

Name of *Marma*	**Number**
Utkshepa	1
Sthapni	2
Total	3

The *Vishalyaghna Marmas* are possessed of *Vataja* Properties. As long as the dart does not allow the *Vayu* to escape from their injured area, the life prolongs but as soon as the dart is extricated, the *vayu* escapes from the injured area and proves to be fatal.

5.) *Kalantarpranahara Marma*:

"वक्षौमर्माणि सीमन्ततलक्षिप्रेन्द्रवस्तयः । कटिकतरुणे सन्धी पार्श्वजौ बृहती च या ।
नितम्बाविति चैतानि कालान्तरहराणि तु ॥"

(सु.शा.६/१०)

Name of marma	**Noumber**
Talahridaya	4
Kshipra	4
Seemanta	5
Indrabasti	4
Apalapa	2
Stanarohita	2
Apastambha	2
Stanmoola	2
Parshwasandhi	2
Katikataruna	2

Nitambha	2
Bruhati	2
Total	33

“ हते कालान्तरघ्ने तु ध्रुवो धातुक्षयो नृणाम् ।

ततो धातुक्षयाज्जन्तुर्वेदनाभिश्च नश्यति ॥”

(सु.शा.६/३९)

The *Kalantara- Pranahara marmas* are possessed of *agneya* and *soumya* properties. As the fiery virtues are enfeebled easily and the cooling virtues take a considerable time, these *marma*s prove fatal in the long run.

Classification of *marma*s based on *Pramana*:

Vagbhata and *Sushruta* mentioned the *pramanas* in *angulas* of all the 107 *marma*. This helps the surgeons to get an exact idea of the anatomical boundaries of the *marma*s and can safely do surgical - parasurgical procedures without causing an injury to the *marma*s.

Table 4: *Pramananusara marma* can be categorised under following categories –

“उर्व्यः शिरांसि विटपे च सकक्षपार्श्व एकैकमङ्गुलमितं स्तनपूर्वमूलम ।

सिद्ध्यङ्गुलद्वयमितं मणिबन्धगुल्फं त्रीण्येव जानु सपरं सह कूर्पराभ्याम् ।

ह्रद्वस्ति– कूर्च– गुद– नाभि– वदन्ति मूर्ध्नि चत्वारि पञ्च च गले दश यानि च द्वे ।

तानि स्वपाणितलकुञ्चितसंमितानि शेषाण्यवेहि परिविस्तरशोऽङ्गुलार्धम् ॥

एतत्प्रमाणमभिवीक्ष्य वदन्ति तज्ज्ञाः शस्त्रेण कर्मकरणं परिहृत्य कार्यम् ।

पार्श्वभिघातितमपीह निहन्ति मर्म तस्माद्धि मर्मसदनं परिवर्जनीयम्।”[19]

(सु.शा.६/२९–३१)

Urvi, krukatika, *vitapa* and *kaksadhara marmas* measure one finger each; *stanamula, manibandha* and *gulpha* are two fingers each; *janu* and *kurpara* are three fingers each.

*Hrdaya, basti, kurcha, gud*a and *nabhi* along with four *shringatakas*, five *simantas* and twelve blood vessels measures four fingers each; the remaining (fiftysix) *marmas* should be known as half finger breadth.

Others take these fiftysix *marmas* as measuring equal to closed palm or fist. *Gayi*, however, reads another version and, following *Bhoja,* interprets *stanamula, gulpha, indrabasti* and *manibandha*- these ten *marmas* as measuring two fingers each; similarly in his view, *janu* (two), *ani*(four) and *kurpara*(two)- these eight *marmas* measure three fingers.

Expert say that surgical operations be performed after considering the measurement of the *marmas* so as to avoid them. As injured even on margin *marma* leads to death, the site of vital spot should be avoided altogether.

1) *Ek angul pramana*:

Kakshadhara	2
Kurchashira	4
Urvi	4
Vitapa	2

2.) *Dwaya angul pramana*:

Manibandha	2
Gulpha	2

***3.) Trayangul Praman*:**

Kurpara	2
Janu	2

4.) ***Ardhangul pramana*:**

Vidhura	2
Utkshepa	2
Talhridaya	4
Sthapani	2
Stanarohita	2
Sankha	2
Phana	2
Parshwasandhi	2
Nitambha	2
Lohitaksha	2
Kukundara	2
Kshipra	2
Krukatika	2
Katikataruna	2
Indrabasti	2
Bruhati	2
Avarta	2
Apastambha	2
Apanga	2
Ansaphalaka	2
Ansa	2
Ani	4
Adhipati	1

NUMBER OF *MARMA* AS PER *SHADANGA*:

"तेषामेकादशैकस्मिन् सक्थिन भवन्ति, एतेनेतरसक्थि बाहू च व्याख्यातौ,
उदरोरसोर्द्वादश, चतुर्दश पृष्ठे, ग्रीवां प्रत्यूर्ध्वं सप्तत्रिंशत् ॥"

(सु.शा.६/४)

" सप्तोत्तरं मर्मशतं तेषामेकादशादिशत् ।
पृथक्सक्थ्नोस्तथा बाह्वोस्त्रीणि कोष्ठे नवोरसि ।
पृष्ठे चतुर्दशोर्ध्वं तु जत्रोस्त्रिंशच्च सप्त च।"

(अ. हृ. शा.४/१)

Sr.No.	***Anga***	**Number of *marmas***
1.	*Jatrurdhva*	37
2.	*Prushtha*	14
3.	*Koshtha*	3
4.	*Ura*	9
5.	*Shakha*	44
Total		107

***MARMA VIDDHA SAAMANYA LAKSHANAS*:**

"भ्रमः प्रलापः पतनं प्रमोहो । विचेष्टनं संलयनोष्ण ते च ।
स्त्रास्ताङ्गता मूर्च्छनमुर्ध्ववातस्तीव्रा रुजो वातकृताश्च तास्ताः ।
मांसोदकाभं रुधिरं च गच्छेत् । सर्वेन्द्रियार्थोपरमस्तथैव।
दशार्धसंख्येष्वपि विक्षतेषु । सामान्यतो मर्मसु लिङ्गमुक्तम् ॥"

(सु.सू.२५/३४)

'भ्रमः प्रलापः पतनं प्रमोहो विचेष्टनं ग्लानिरथोष्णता च
स्त्रस्ताङ्गता मूर्च्छन्मूर्ध्ववातस्तीव्रा रुजा वातकृताश्च तास्ताः ।
मांसोदकाभं रुधिरं च गच्छेत् सर्वेन्द्रियार्थोपरमस्थैव ।

दशार्धसंख्येष्वपि विक्षतेषु सामान्यतो मर्मसु लिङ्गमुक्तम् ॥

(यो.र.उ.ख. सद्योव्रणनिदान १८/१९)

"सामान्येनैव च – देहप्रसुप्तिर्गुरुता संमोहः शीतकामिता ।
स्वेदो मूर्च्छा वमिः पार्श्वासो मर्मविद्धस्य लक्षणम् ॥"

(अ. सं. शा.७/४७)

Injury to the *Marma* point can cause irregular pulsations, numbness, heaviness, and sudden onset of pain, unconsciousness, affinity to cold, sweating, vomiting and dyspnoea. Vertigo, shivering, tachycardia, heartburn and restlessness. The above symptoms are considered as the *marma*bhigata *lakshanas* which result in bad prognosis when a *marma* is injured. [20]

PROGNOSIS AFTER INFLICTION OF INJURY:

A.) Nearby *Marma*:

"तत्र सद्यःप्राणहरमन्ते विद्धं कालान्तरेण मारयन्ति ।
कालान्तरप्राणहरमन्ते विद्धं वैकल्यमापादयति ।
विशल्यघ्नं वैकल्यकरं च भवति ।
वैकल्यकरं कालान्तरेण क्लेशयति रुजां च करोति ।
रुजाकरमतीव्रवेदनं भवति ।"

(सु.शा.६/२३)

Injury to the nearby point of the *sadyapranhara marma* results into death a little later, i.e. within a month or a forthnight like *kalantarpranahara marma*.

Injury to the nearby point of the *kalantarpranahara marma* results into deformity of body parts like *vaikalyakara marma*.

Injury to the nearby site of the *vishalyaghan marma* results into deformity of body parts as in *vaikalyakara marma*.

Injury to the nearby site of the *vaikalyakara marma* results into pain and agony in due course of time.

Injury to the nearby site of the *Rujakara marma* produces excruciating pain which is not that sharp.

At *Marma* Point:

"तत्र सद्यः प्राणहराणि सप्तरात्राभ्यन्तरान्मारयन्ति,
कालान्तरप्राणहराणि पक्षान्मासाद्वा,
तेष्वपि तु क्षिप्राणि कदचिदाशु मारयन्ति,
विशल्यप्राणहराणि वैकल्यकराणि च कदाचितदत्यभिहतानि मारयन्ति ॥

(सु.शा.६/२४)

Injury to the *sadyapranahara marma* proves fatal and brings about death within seven days of infliction.

Injury to the *kalantara pranahara marma* brings about death in a forthnight or within a month.

Injury to the *Vishalyaghan marma* brings about death as soon as the trapped *prana* escapes out after the removal of dart (*shalya*).

Injury to the *Vaikalyakara marma* produces deformity generally but can prove fatal if injured severely.

Injury to the *Rujakara marma* produces severe pain. Its injury does not bring about death, but pain produces severe agony.

KRUKATIKA MARMA:

<u>कृकाटिका मर्म</u>

- "शिरोग्रीवयो: सन्धाने कृकाटिका नाम्, तत्र चलमुर्धता।" (21)

(सु.शा.६/३६, घाणेकर टिका)

शीर व ग्रीवा संधानाचा पाठीमागील भाग.

- "कृकाटिकं नाम अंगुरीयकाकारं तरुणास्थि, स्वरयन्त्रधरावयवभुतम् ।"

(म.म. गनानाथ सेन)

- "कृकाटिके शिरोग्रीवासन्धौ, तत्र चलं शिर: ।"(22)

(अ. हृ.शा.४/२९)

संख्या – २

स्थान – "जत्रुण उर्ध्व...,शिरो ग्रीवयो सन्धाने ।"

परिमाण – अर्धांगुल परिमित.

प्रकारः १. परिणामानुसार –वैकल्यकर मर्म.

विध्द लक्षण **–** चलमुर्धता.

२. रचनेनुसार – संधिमर्म.

रचना – हे मर्म म्हणजे शिर आणि ग्रीवा यांच्या संधिचा पश्चिम भाग होय. म्हणजे पश्चिम कपालास्थि आणि प्रथम ग्रीवा कशेरुका (चूडावलय) यांच्यामधील संधि (Atlanto occipital Joint) होय. याशिवाय या मर्माच्या निर्मितीमध्ये त्या संधिचे संधिबंध व कला यांचाही समावेश होतो.

उदा.–

1. चूडा पश्चादिका कला (Atlanto occipital Membrane)
2. चूडा पश्चादिका बंध (lat. Atlanto occipital Lig.)

त्यामुळे या मर्मावर आघात झाल्यास या संधिबंधांची हानी होऊन संधिमध्ये विकृति निर्माण होते व त्यामुळे शिर मानेवर स्थिर न राहता थरथर

- कृकाटिका(स्त्री)– मर्म (सु.शा.६) [२३]

  एक मर्मस्थान– मान व डोके यांच्या संधिस्थानी.

- चल (वि)– अस्थिर (च. सु.)

  चञ्चल.[२४]

Thus, *krukatika marma* is situated on the joint of head and neck. It is type of *vaiklyakara marma*, and also itself one of the *sandhi marma*. And '*Chalmurdhta*' is the *vailyakar lakshana* of *krukatika marma*.

SANDHI AND _MARMA_ RELATION:-

"जानु कूर्पर सीमन्ताधिपति गुल्फ मणिबन्ध कुकुन्दरावर्त
कृकाटिकाश्चेति सन्धिमर्माणि ।"

(सु.शा.६/७)

"सन्धौ विंशतिरावर्तौ मणिबन्धौ कुकुन्दरौ ॥
सीमन्ताः कूर्परौ गुल्फौ कृकाटयौ जानुनी पतिः ।"

(अ.हृ.शा.४/४४)

Meaning of murdha:

Viddha lakshana or *vaiklyakara lakshana* of *krukatika marma* is "*Chalmurdhta"*, different *Acharya* elaborate the meaning of *'murdha'*.

मुर्धन –(पु) माथा/ सर्वोच्च स्थान/ आधार. [२५]

In *Sanskrit shabdkosh* meaning of murdha is head. Superior part of the body. The head in general. top, summit, peak, head.

मुर्धा – उत्तमांगम(वराङ्गम)/शिरः /शीर्षम /मस्तकः /सिर.[२६]

कृकाटिका– गर्दन के पीछेवाला भाग.

According to *Amarkosha* the word *murdha* meand head(*shirsh*), The highest or most prominent part (*Uttamang)*. Also told the meaning of word *krukatika* is "*griwayam unnat bhaga*" i. e. the back region of the neck, or the raised and straight part of the neck. [25] the joint of neck and head.

मुर्धन – (पु) शिरसः उपरितनो भाग/ शिरः (अ. सं.शा.१०/१२)[२७]

Also, *Ayurvediya shabdkosh* and *Parishadhy shabdarth shariram* gives the same meaning of murdha.

मूर्धा – यह शिर का पर्याय है।[२८]

Thus, *chalmurdhta* means the shaking movments of neck and head or the involuntary movements of neck.

Involuntary movements:

Meaning of involuntary movements according to different Authors-

1. Acting or done without or against will. (29)

2. Performed or acting without conscious control OR Carried out without one's conscious wishes, not voluntary. (30)

3. Involuntary movements mean unintentional: unconscious. OR not voluntary: independent of one's will OR functioning without volition. (31)

4. Acting or happening without forethought, prompting, planning. (32)

KRUKATIKA MARMA

Krukatika – Articulation between the Occipital & Atlas.

Atlanto-Occipital articulation.

These are *Sandhi marmas* at the junction of Head & the neck; each is of the *vaikalyakara* type and half *anguli* in size. Injury to them cause shaking or tremors.

Classical aspect

Fourteen *marma* are present in the neck region. *krukatika* two among them. Located at the junction of *shiras* (head) and *greeva* (neck) constituted by *sandhi* (joint) and measures only 1 cm (half *angul*) dimension. Injury to this give rise to *Chalmurdhta* (loss of stability of head), therefore this is included under *vaikalyakara* (deformity) category.

Krukatika marma form the junction of head and neck and thus the most delicate area. Any injury to this *Marma* causes instability to the head. Therefore, any injury or painful conditions or swelling in this area should be addressed with top priority since *Krukatika Marma* would be involved. (33)

Anatomical feature of *krukatika* region-

Krukatika marma is located in the region of craniocervical junction.

Structure involved –

Atlanto-occipital joint,

Atlanto-occipital membrane,

Atlanto-occipital ligament. [34]

1. Atlanto occipital joint –

The atlanto-occipital joint (articulation between the atlas and the occipital bone) consists of a pair of a pair of a pair of condyloid joints. The atlanto-occipital joint is a synovial joint.

Attachments – Anterior atlanto-occipital membrane; dense, broad fibrousstructure which connects the anterior arch of atlas to the anterior clivus; it is continuation of the anterior longitudinal ligament and prevents excessive neck extension.

Posterior atlanto–occipital membrane: a broad but thin fibrous membrane which connects the posterior foramen magnum to the superior aspect of the posterior atlantal arch and blends with the joint capsule laterally.

2. Atlanto–occipital ligament - The ligaments connecting the Bones are

Two articular capsules.

Posterior atlanto–occipital membrane.

Anterior atlanto–occipital membrane.

3. Atlanto occipital membrane-

The posterior atlanto-ocipital membrane broad but thin membrane it is connected above to the posterior margin of the foramena magnum and bellowto the upper border of the posterior arch of the atlas. On each side of this membrane there is defect above the groove for the vertebral artery which serves as an opening for the entrance of the artery. The suboccipital nerve also passes through this defect. The free border of membrane arches over the artery and nerve and is sometime ossified.

Modern Review

Basic Anatomy

The head and neck region of the body is one in which a large number of important structures are compressed into relatively small area. It is a very interesting region, since it contains the brain, the special sense organs, the cranial nerves & branches of the cervical plexus.

Neck

The neck can be defined as the body that lies between the lower margin of occipital bone above &the suprasternal notch & the upper border of the clavicle below.

The neck is the start of the spinal column & spinal cord. The spinal columns contain about two dozen inter connected, oddly shaped, bony segments, called vertebrae. The neck contains seven of these known as the cervical vertebrae. They are the smallest & upper most vertebrae in the body. [35]

THE VERTEBRAL COLUMN

The vertebral column is the central bony pillars of the body. It supports the skull, pectoral girdle, upper limbs, and thoracic cage, and by way of the pelvic girdle, transmits body weight to the lower limbs. Within its cavity lie the spinal cord, the roots of the spinal nerves, and the covering meninges, to which the vertebral column gives great protection.

COMPOSITION OF THE VERTEBRAL COLUMN:

The vertebral column is composed of **33** vertebrae –

07 cervical,
12 Thoracic,
05 Lumbar,
05 Sacral (fused to form the sacrum),
04 Coccygeal (the lower three are commonly fused).

Because it is segmented and made up of vertebrae, joints, and pads of fibro cartilage called **intervertebral discs,** it is a flexible structure. The intervertebral discs from about one-fourth the length of the column.

VERTEBRAE:

Although vertebrae show regional differences, they all possess a common pattern.

A **typical vertebra** consists of a rounded body anteriorly and **vertebral arch** posteriorly. These enclose a space called the **Vertebral Foramen**, though which run the spinal cord and its coverings.

The vertebral arch consists of a pair of cylindrical **pedicles**, which form the sides of the arch, and a pair of flattened **laminae**, which complete the arch posteriorly. The vertebral arch gives rise to seven processes, one spinous, two transverse, and four articular. The socalled **posterior elements** of vertebrae include all parts of the vertebrae that are situated posterior to the body of the vertebrae.

The **spinous process**, or **spine**, is directed posteriorly from the junction of the two laminae. The **transverse processes** are directed laterally from the junction of the laminae and the pedicles. Both the spinous and transverse processes serve as levers and receive attachments of muscular and ligaments.

The **articular processes** are vertically arranged and consist of two superior and two inferior processes. They arise from the junction of the laminae and the pedicles, and their articular surfaces are covered with hyaline cartilage. The two superior articular processes of one vertebral arch articulate with the two inferior articular processes of the arch above, forming two synovial joints.

The pedicles are notched on their upper and lower borders, forming the **superior** and **inferior vertebral notches**. On each side, the superior notch of one vertebra and the inferior notch of an adjacent vertebrae together form an **intervertebral foramen**. These foramina, in an articulated skeleton, serve to transmit the spinal nerves and blood vessels. The anterior and posterior nerve roots of a spinal nerve unite within these foramina with their coverings of dura to form the segmental spinal nerves.

- **Characteristics of a Typical Cervical Vertebra.**

A typical cervical vertebra has the following characteristics:

1. The transverse processes possess a foramen transversarium for the passage of the vertebral artery and veins.

2. The spines are small and bifid.

3. The body is small and broad from side to side.

4. The vertebral foramen is large and triangular.

5. The superior articular processes have facets that face backward and upward; the inferior processes have facets that face downward and forward.

- **Characteristics of the Atypical Cervical Vertebrae.**

The first, second, and seventh cervical vertebrae are atypical vertebrae.

The **first cervical vertebrae** or **atlas.**

1. Does not possess a body.

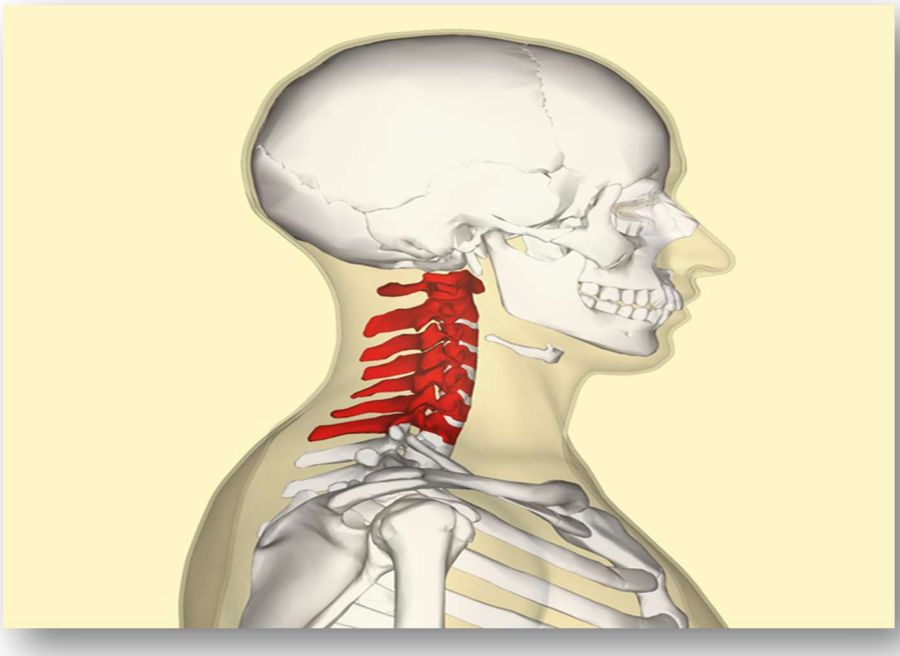
2. Does not have a spinous process.

3. Has an anterior and posterior arch.

4. Has a lateral mass on each side with articular surface on its upper surface for articulation with the occipital condyles (atlanto-occipital joints) and articular surfaces on its lower surface for articulation with the axis (atlanto-axial joints).

The second cervical vertebra or axis has a peg like odontoid process that projects from the superior surface of the body (representing the body of the atlas that has fused with the body of the axis).[35]

Cervical vertebrae:



Cervical spine is made up of seven cervical vertebrae. The cervical spine is made up of two anatomically and functionally different segments. These two segments work together to produce rotation, lateral flexion, flexion and extension of the head and neck. The cervical spine is much more mobile than the thoracic or lumbar region of the spine. C1-C2 are the atypical vertebrae. C1 and C2 form a unique set of articulations that provide a great degree of mobility for the skull. Approximately 50% of flexion and

extension occurs between the occipital and C1 vertebrae, 50% of the rotation of the neck happen between C1 and C2.

C3-C7 are typical type of vertebrae having a body, pedicles, laminae, spinous processes and a facet joint. They are not much as upper cervical spine give support and stability to cervical spine. The cervical spine has transverse foramina in each vertebra for the vertebral arteries that supply blood to the brain.

First Cervical Vertebrae:

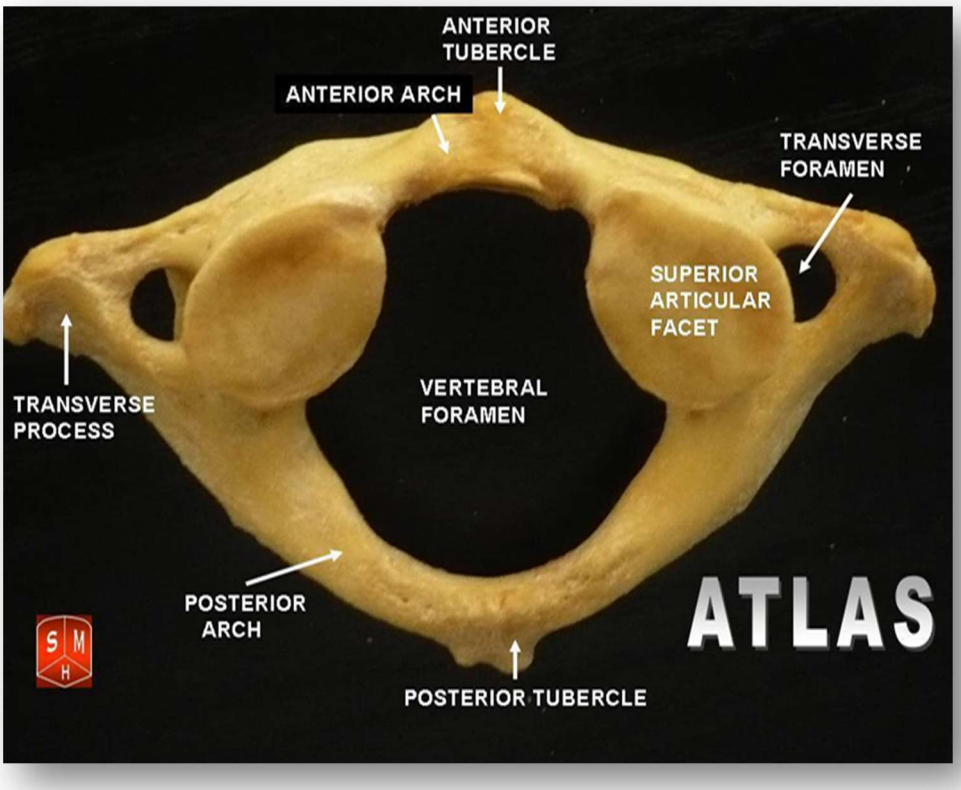
In anatomy Atlas is the most superior cervical vertebrae of spine. It is named for the atlas of Greek mythology, because it supports the globe of the head. The atlas vertebrae with axis vertebrae forms the joint connecting the skull and spine. The atlas and axis are specialized to allow a greater range of motion than normal vertebrae. They are responsible for the nodding and rotation movements of the head.

The atlanto-occipital joint allows the head to nod up and down on the vertebral column. The dens act as a pivot that allows the atlas and attached head to rotate on the axis, side to side. The atlas chief peculiarity is that it has no body. It is ring like and consist of anterior and posterior arch and two lateral masses. The atlas and axis are important neurologically because the brain stem extend down to the axis. [36]

Development:

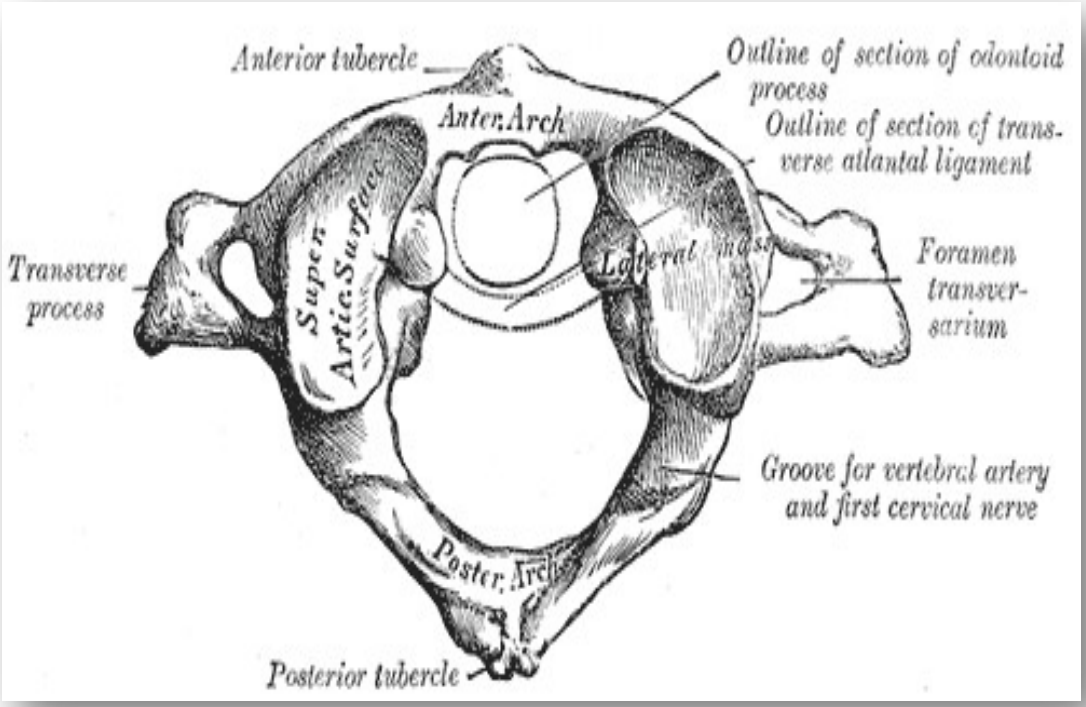
The atlas is usually ossified from three centers. Of these, one appears in each lateral mass about one seventh week of fetal life, and extends backward. At birth, these portions of bones are separated from one another behind by a narrow interval filled with cartilage.

Between the third and fourth years they unite either directly or through the medium of a separate center developed in the cartilage. At birth the anterior arch consists of cartilage, in this a separate center appears about the end of the first year after birth, and joints the lateral masses from the sixth to eight years. The lines of union extend across the anterior portions of the superior articular facets.



Occasionally there is no separate center, the anterior arch being formed by the forward extension and the ultimate junction of two lateral masses, sometimes this arch is ossified from two centers, one on either side of the middle line.

Structure:



Anterior arch

The anterior arch forms about one-fifth of the ring its anterior surface is convex, and present at its center the anterior tubercle for the attachment of the Longus colli muscles and the anterior longitudinal ligament. Posteriorly it is concave and marked by smooth, oval or circular facet (fovea dentis), for the articulation with the odontoid process (dens) of the axis.

The upper and lower borders respectively give attachment to the anterior atlanto-ocipital membrane and the anterior atlantoaxial ligament, the former connects it with the occipital bone above, and the latter with the axis below.

Posterior arch

The posterior arch forms about two-fifths of the circumference of the ring it ends behind in the posterior tubercle, which is the rudiment of a spinous process and give origin to the recti capitis posteriores minores and the ligamentum nuchae. The diminutive size of this process prevents any interference with the movements between the atlas and the skull.

The posterior part of the arch present above and behind a rounded edge for the attachment of posterior atlanto-occipital membrane, while immediately behind each superior articular process is the superior vertebral notch. This is a groove that sometimes converted into foramen by ossification of the posterior atlanto-occipital membrane to create a delicate bony speculum which arches backward from the posterior end of the superior articular process. This anatomical variant is known as arcuate foramen.

This groove transmits the vertebral artery, which after ascending through the foramen in the transverse process, winds around the lateral mass in a direction backward and medially to enter the vertebrobasillar circulation through the foramen magnum, it also transmits the suboccipital nerve.

Lateral mass:

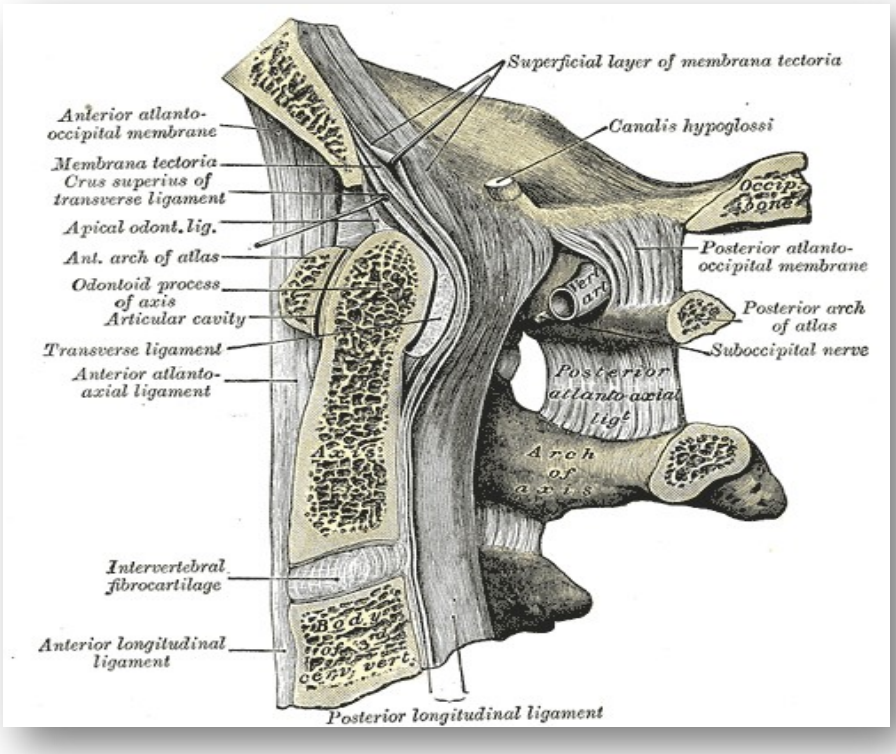
The lateral mass is the bulkiest and solid parts of the atlas, in order to support the weight of head.

Each carry two articular facets, a superior and an inferior facet.

- The Superior facets are of large size, oval, concave, and approach each other in front, but diverge behind they are directed upward, medially, and a little backward, each forming a cup for the corresponding condyl of the occipital bone, and are admirably adapted to the nodding movement of the head.

- The inferior articular facet is circular in form, flattened or slightly convex and directed downward and medially, articulating with the axis, and permitting the rotatory movement of the head.

Transverse process



The transverse process is large, they project laterally and downward from the lateral mass, and serve the attachment of muscles which assist in rotating the head. They are long, and their anterior and posterior tubercles are fused into one mass, the foramen transversarium is directed from below, upward and backward.

Vertebral foramen

Just below the medial margin of each superior facet is small tubercle, for the attachment of the transverse atlantal ligament which stretches across the ring of the atlas and divide the vertebral foramen into two unequal parts.

- The anterior or smaller receiving the odontoid process of the axis. The Posterior transmitting the spinal cord and its membranes. This part of the vertebral canal is of considerable size, much greater than is required for the accommodation of the spinal cord.

Second Cervical Vertebrae:

In anatomy the second cervical vertebrae of spine are also called as Axis or

epistropheus. By the atlanto-axial joint, it forms the pivot upon which the first cervical vertebra, which carries the head, rotates.

The most distinctive characteristic of this bone is the strong odontoid process known as dens which rises perpendicularly from the upper surface of the body. The peculiar feature gives to the vertebrae a rarely used third name vertebrae dentate.

Development:

The axis is ossified from five primary and two secondary centers.

- The body and vertebral arch are ossified in the same manner as the corresponding part in the other vertebrae. One center for the body and two centers for the vertebral notch.

- The center of the arch appears about the seventh and eighth week of a fetal life, while the center of the body appears in about fourth or fifth month.

- The dens or odontoid process consists originally of a continuation upward of the cartilaginous mass, in which lower part of the body is formed.

- About the sixth month of fetal life, two centers make their appearance in the base of this process they are placed laterally and join before the birth to form a conical bilobed mass deeply cleft above, the interval between the sides of the cleft and summit of the process is formed by a wedgeshaped piece of cartilage.

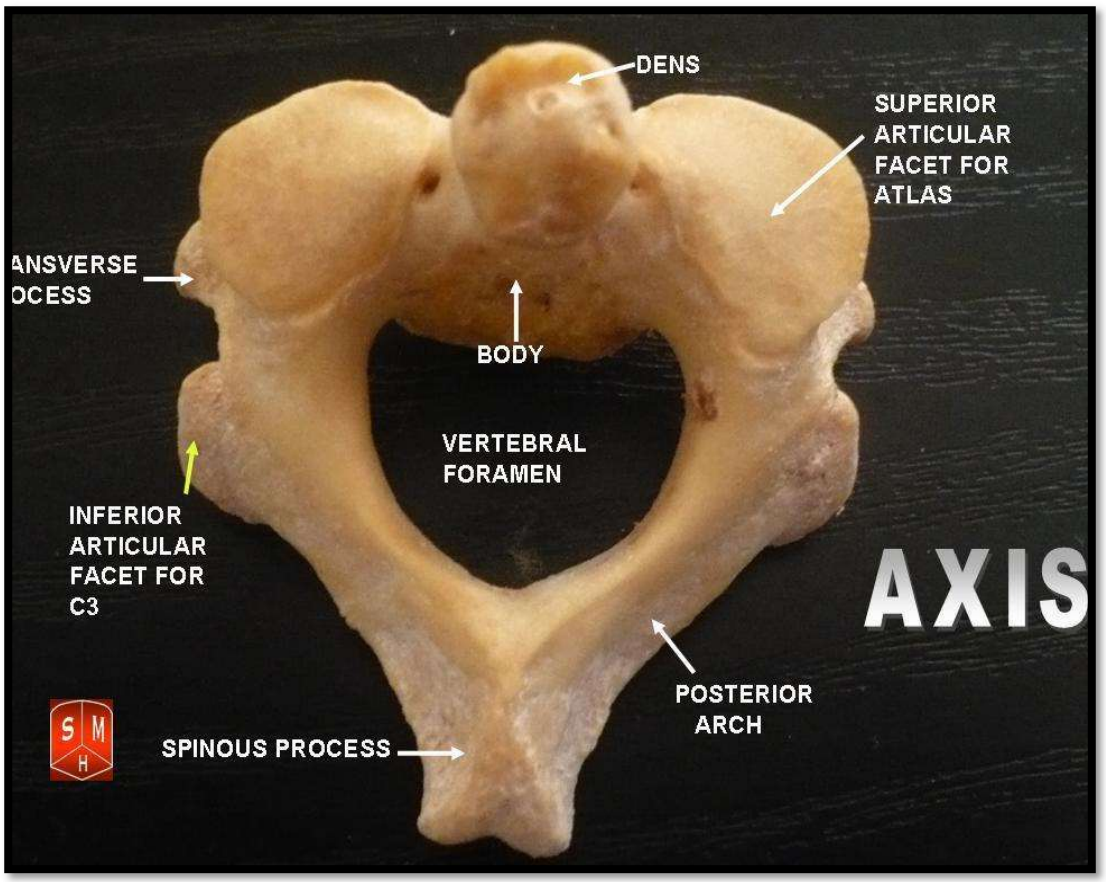
- The base of the process is separated from the body by a cartilaginous disk, which gradually become ossified at its circumference, but remain cartilaginous in its center until advanced age.

- In this cartilage, rudiments of the lower epiphyseal lamella of the atlas and the upper epiphyseal lamella of the axis may sometimes be found.

- The apex of the odontoid process has a separate center which appears in the second and joins about twelveth year this is the upper epiphyseal lamella of the atlas.

- In addition to these there is a secondary center for a thin epiphyseal plate on the under surface of the body of the bone.

Structure:

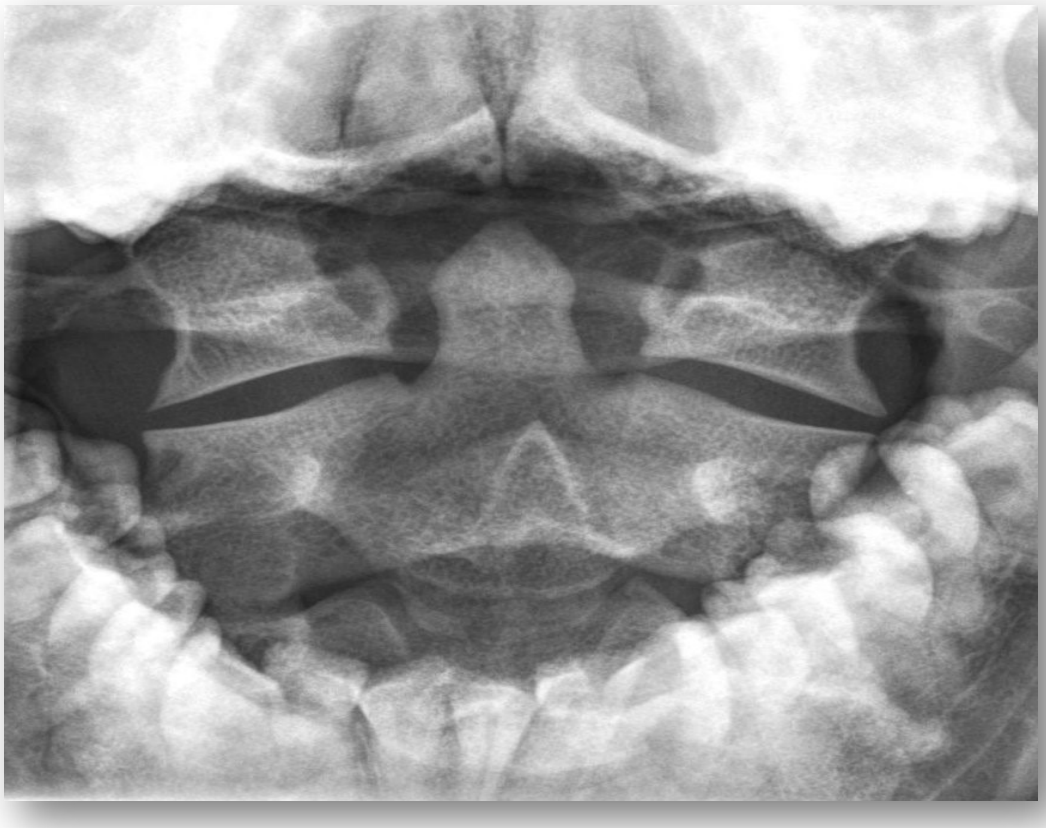


The body is deeper in front than behind, and prolonged downward anteriorly so as to overlap the upper and front part of the third vertebrae.

It presents in front a median longitudinal ridge, separating two lateral depressions for the attachment of the longus colli muscles. It's under surface is concave from before backward and convex from side to side.

Dens:

The dens, also odontoid process or peg, is the most pronounced feature, and exhibits a slight constriction or neck where it joins with the main body of vertebra. The dens are the projection of the axis vertebrae. The condition where the dens is separated from the body of axis is called as odentoideum, may cause nerve and circulation compression syndrome.



On its anterior surface is an oval or nearly circular facet for articulation with that on the anterior arch of the atlas. On the back of the neck, and frequently extending on to its lateral surfaces, is a shallow groove for the transverse atlantal ligament which retain the process in posting the apex is pointed and give attachment to the apical odontaoid ligament below the apex the process is somewhat enlarged, and presents on either side a rough impression for the attachment of the alar ligament, these ligaments connect the process to the occipital bone. The internal structure of the odontoid process is more compact than that of the body.

Feature

- The pedicles are broad and strong, especially in front, where they coalesce with the sides of the body and the root of the odontoid process. They are covered by the articular surfaces.

- The lamina is thick and strong, and the vertebral foramen large, but smaller than that of atlas.

- The transverse processes are very small and each end in a single tubercle, each is perforated by the transverse foramen, which is directed upward and laterally.

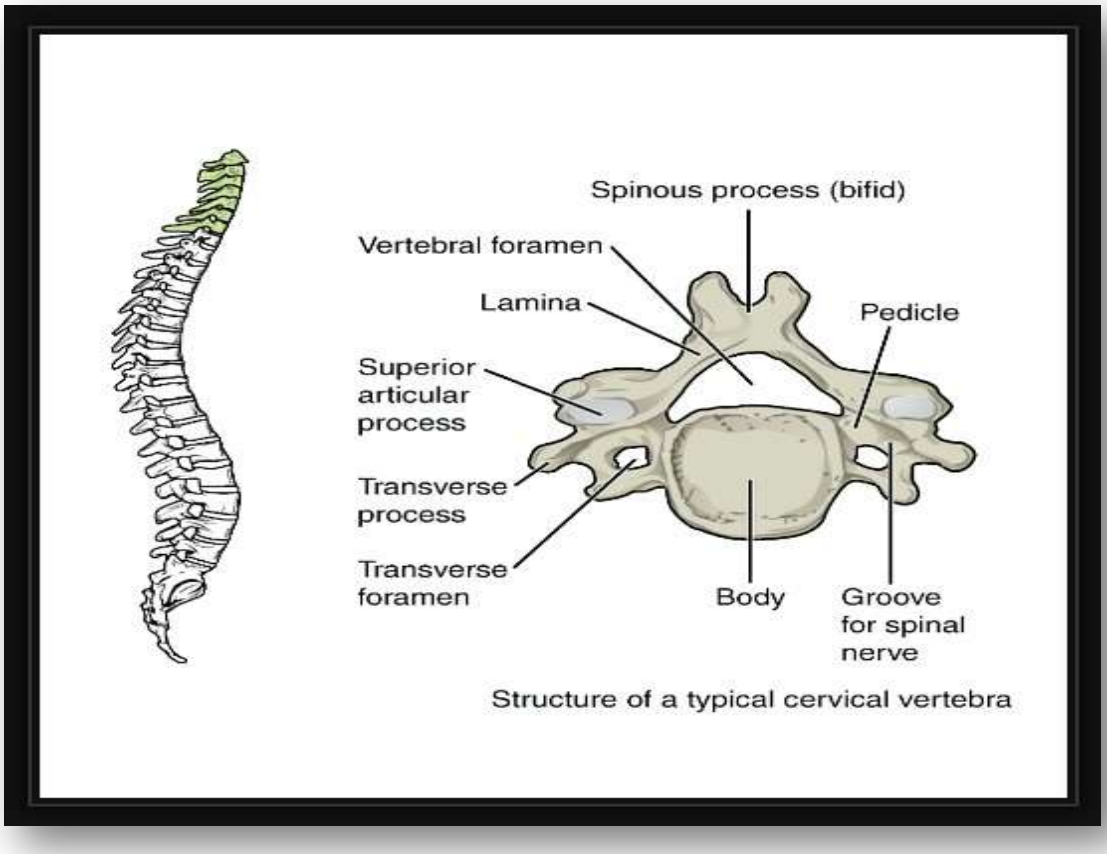
- The superior articular surfaces are rounds, slightly convex, directed upward and laterally, and are supported on the body, pedicles and the transverse process.

- The inferior articular surface has the same direction as those of the cervical vertebrae.

- The superior vertebral notches are very shallow, and lie behind the articular processes, the inferior lie in front of the articular process, as in the other cervical vertebrae.

- The spinous process is large, very strong, deeply channel on it's under surface and present a bifurcated extremity.

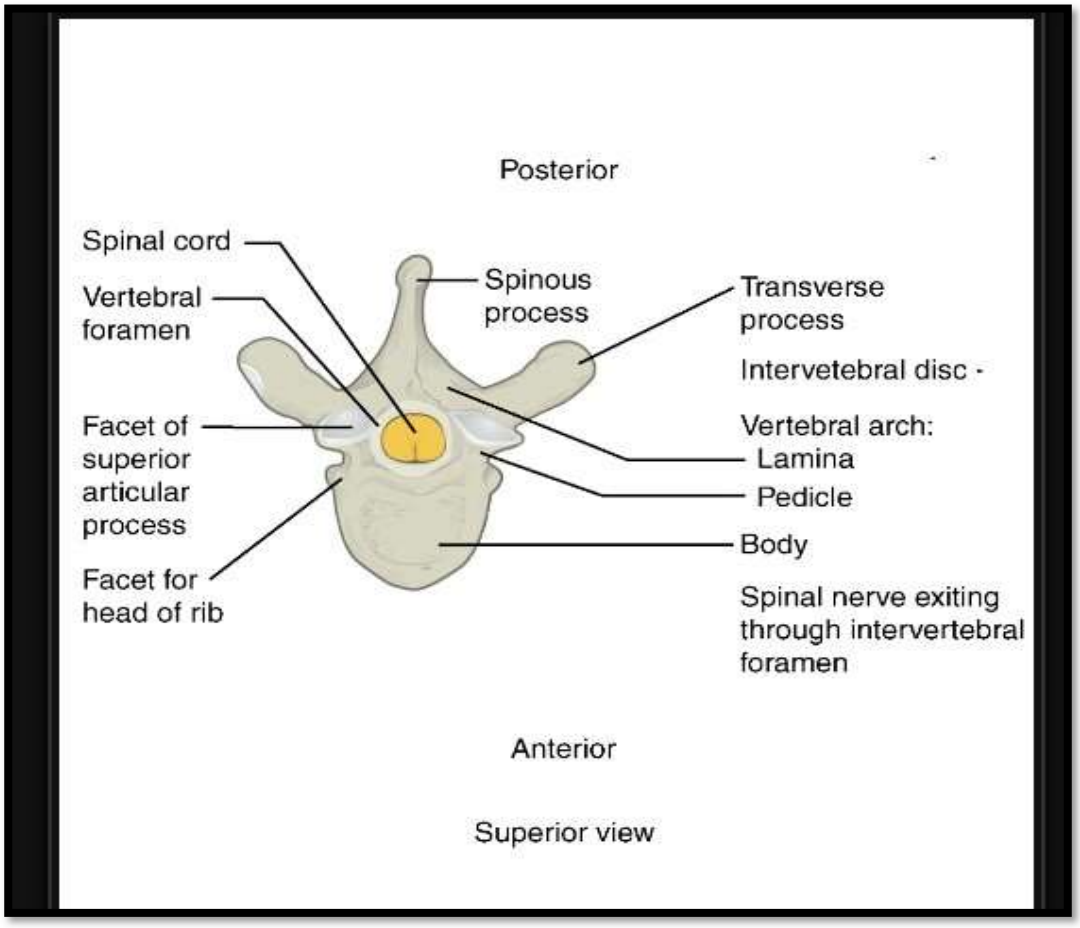
Third cervical vertebrae:



Third cervical vertebrae are a part of lower cervical spine. It is a 'Typical' type of vertebra. The five cervical vertebrae that make up the lower cervical spine, C3-C7 are similar to each other but very different from C1 and C2. Each has a vertebral body that is concave on its superior surface and concave at its inferior surface on the superior surface of the bodies are raise process or hooks called uncinated processes, each of which articulate with a depressed area on the inferior lateral aspect of the superior vertebral body, called the echancrure or envil.

These uncovertebral joints are most noticeable near a pedicle and are usually referred to as the joint of luschka. They are believed to be the result of degenerative changes in the annulus, which lead to fissuring in the annulus and creation of the joint. These joints can develop osteophyte spurs, which can narrow the intervertebral foramina.[35]

C3 are typical type of vertebrae having a body, pedicles, laminae, spinous processes and a facet joints.



Vertebral body

- The body of this vertebra is small and transverse diameter is greater than anterio-posterior and height dimentions.

- The anterior and posterior surfaces are flattened and of the equal depth the former is placed on a lower level than the latter and is inferior border are prolonged downward, so as to overlap the upper and forepart of the vertebrae below.
- The upper surface is concave transversely and presents a projecting lip posterolaterally on the lateral side uncinated process.
- The lower surface is concave from front to back, convex from side to side and present a shallow cavities laterallywhich receive the projecting lips of the underlying vertebrae.

Vertebral foramen

- It is triangular in shape.

Bony structures

- The Pedicles are short and project posterolaterally. They are attached to the body midway between its upper and lower borders, so that the superior vertebral notch is as deep as the inferior.

- The Laminae are long, narrow and thinner above than below. They curve posteromedially.

- The spinous process is short and bifid.

- The superior and inferior Articular process of cervical vertebrae have fused on either or both sides to form articular pillars, column of the bone project laterally from the junction of the pedicle and lamina.

- Articular facet are flat and of an oval form the superior face backward , upward and slightly medially. The inferior face forward, downward and slightly laterally.

- The Transverse processes are short and house the foramen transversarium.

CRANIOVERTEBRAL JOINTS

Articulation of the cranium and vertebral column is by means of paired atlanto – occipital joints and the ligaments between the axis and occipital bones; it is appropriate that the joints between atlas and axis at which the head rotates are also included here.

ATLANTO-AXIAL JOINTS

Articulation of atlas to axis is at three synovial joints, a pair between inferior atlantal and superior axial facets and a median complex between the axial dens and atlantal anterior arch and transverse ligament.

LATERAL ATLANTO –AXIAL JOINT

The lateral atlanto- axial joints are often classified as planar but the cartilaginous articular surfaces are ovoid, the atlantal slightly concave, the axial reciprocally convex. According to kapandji both facets are transversely cylindrical, engaging like wheels.

LIGAMENTS

FIBROUS CAPSULE - Fibrous capsules are thin, loose attached at their articular margins and lined by synovial membrane. Each has a posteromedial accessory ligament attached below to the axial body near the transverse ligament.

ANTERIOR LONGITUDINAL LIGAMENT – The vertebrae are connected in front by the anterior longitudinal ligament here a strong and wide band fixed above to the lower border of the anterior atlantal arch, below to the front of the axial body. It thickens into a median cord connecting the anterior atlantal tubercle to the axial body. They are joined by a broad, thin membrane attached above to the lower border of the atlantal arch, below to upper edges of the axial laminae in series with ligament flava; it is pierced laterally by the second cervical spinal nerves.

MEDIAN ATLANTO-AXIAL JOINT

The median atlanto- axial joint is a pivot joint between the axial dens and a ring formed by the atlantal anterior arch and transverse ligament; it has two synovial cavities which act in concert. A facet on the anterior dental surface articulates with one on the posterior aspect of the anterior atlantal arch, having a weak, loose fibrous capsule lined

by synovial membrane. Posteriorly is a large synovial cavity (or bursa) between the cartilaginous anterior surface of the transverse ligament and the posterior grooved aspect of the dens, often continuous with one of the atlanto-occipital joints.

LIGAMENTS

The transverse atlantal ligament, a thick strong band across the atlantal ring, holds the dens against the anterior arch. Attached to a small, medial tubercle on each atlantal lateral mass, it is broader centrally and bears an anterior thin layer of articular cartilage. From its superficial fibres median longitudinal bands ascend and descend, the upper to the superior surface of the basilar occipital bone between the apical ligament of the dens and membrane tectoria; the lower band, which may be absent, reaches the posterior axial surface. The whole complex forms the atlantal cruciform ligament. The transverse ligament divides the ring into unequal parts, the posterior and larger surrounding spinal cord and meninges, the anterior containing the dens, whose neck is embraced posteriorly by the ligament, retaining it in position even when all other ligaments are divided.

MOVEMENTS

Movement at the atlanto-axial joints is simultaneous at all three, consisting basically of atlantal rotation on the axis and limited by alar ligaments. The opposed lateral facets are both slightly convex in anteroposterior axes. Therefore, when gliding back or forwards on the lower facet, the upper also descends, stretch of capsule being diminished by descent of its upper attachments, marking capsular laxity unnecessary.

The lateral atlanto-axial joints support the head via the atlas, the pivot guides rotation. Kapandji has analysed these and other cervical movements, emphasizing the slight helical component in lateral atlanto-axial motion.

Muscles producing rotation- oblique capitis inferior, rectus capitis posterior major and splenius capitis of one side, and contralateral sternocleidomastoid.

ATLANTO-OCCIPITAL JOINTS

Each joint has a facet on its corresponding lateral atlantal mass which is adapted to an opposed occipital condyle; it is ellipsoid in type and articular surfaces are reciprocally curved. Atlantal facets are concave, tilted medially and centrally constricted, the surface partially, sometimes completely, divided. The bones are connected by articular capsules and anterior and posterior atlanto-occipital membranes.

LIGAMENTS

FIBROUS CAPSULE - It surround the occipital condyles and superior atlantal articular facets thickened posterolaterally but thin and sometimes deficient medially, where the synovial cavities often connect with the bursa between dens and transvers atlantal ligament.

THE ANTERIOR ATLANTO-OCCIPITAL MEMBRANE

It is broad and of densely woven fibres, connects the anterior margin of the foramen magnum to the upper border of the anterior atlantal arch; laterally it bends with the capsular ligaments; it is strengthened by the anterior longitudinal ligament to form a median cord between basilar occipital bone and anterior atlantal tubercle.

THE POSTERIOR ATLANTO- OCCIPITAL MEMBRANE

It is broad but thin, connects the posterior margin of the foramen magnum to the upper border of the posterior atlantal arch. It arches over the grooves for the vertebral arteries, completing openings for entrance of the arteries and exit of venous plexuses and the first cervical spinal nerves. The ligamentous border arching over arteries, veins and nerve is sometimes ossified.

MOVEMENTS

In movements at the atlanto-occipital joints their long axes run anteromedially because of this and their articular curvatures, the profiles of both joints are parts of the surface of one ellipsoid, its long axis transverse and anteroposterior axes of movement but not around the vertical, therefore permitting flexion/extension and slight lateral flexion.

MUSCLES PRODUCING THE MOVEMENTS

Flexion: – longus capitis and rectus capitis anterior.

Extension: - Recti capitis posteriors major et minor, obliquus capitis superior, semispinalis capitis, splenius capitis and trapezius

Lateral flexion: - rectus capitis lateralis, semispinalis capitis, splenius capitis, sternocleidomastoid and trapezius (cervical part).

LIGAMENTS CONNECTING AXIS AND OCCIPITAL BONE

The membrana tectoria, paired alar and median apical ligaments extend between axis and occipital bone.

The membrane tectoria, inside the vertebral canal, is a broad strong band covering the dens and its ligaments as a prolongation of the posterior longitudinal ligament. Its superficial and deep laminae are both attached to the posterior surface of the axial body, the superficial lamina expanding as it ascends to the upper surface of the basilar occipital bone, and is attached in front of the foramen magnum, blending with the cranial dura mater; the deep lamina has a median band, extending also to the basilar occipital, and two lateral bands which ascend medial to the atlanto- occipital joints to the margins of the foramen magnum.

The alar ligaments strong rounded cords, start on each side of the apex of the dens and ascend laterally to rough impressions on the medial sides of the occipital condyles. They relax in extension, tauten in flexion, thus limiting movement. They would prevent rotation of the head, were it not for a slight descent of the atlas which relaxes the ligaments enough to compensate for rotational tension. Rotation to the right is checked by tension of those fibres of the right ligament attached to the dens in front of the axis of movement and fibres of the left ligament attached behind the axis and vice versa in left rotation. The apical ligament of the dens extends from its apex to the anterior margin of the foramen magnum between the alar ligaments; it blends with deep fibres of the anterior atlanto-occipital membrane and the upper vertical band of the cruciformligament. It is said to be the core of the centrum of the pro-atlas and contains

traces of notochord. The ligamentum nuchae also connects cervical vertebrae with the cranium.

MUSCLES ON THE BACK OF NECK:

The muscle of back neck performs many important tasks, including movement of the head and neck, stabilizing the upper region of the body. Sternocleidomastoid and trapezius are two largest and important muscles of back of neck. Along with these muscles other small muscles also present there.

Muscle of back of neck are as follows-

1.Trapezius

2.Sternocledomastoid

3.Semispinalis capitis

4.Splenius capitis

5.Rhomboid major

6.Rhomboid minor

7.Serratus posterior superior

8.Levator scapulae

9.Splenius cervicis

10.Longissimus cervicis

11.Longissimus capitis

12.Semispinalis cervicis

13.Rectus capitis posterior minor

14.Rectus capitis posterior major

15.Obliqus capitis superior

16.Oblique capitis inferior

17.Spinalis cervicis

18.Interspinalis cervicis

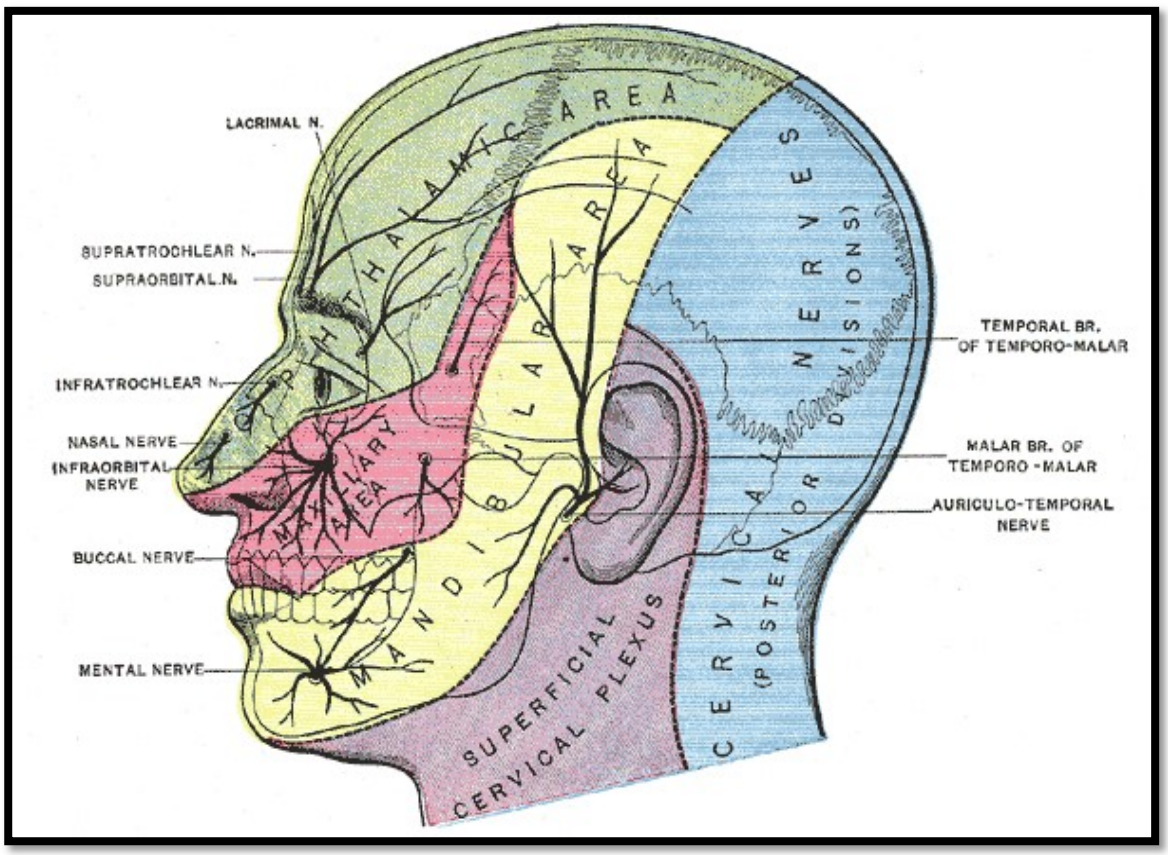
19.Iliocostalis cervicis

20.Anterior scalene

21.Middle scalene

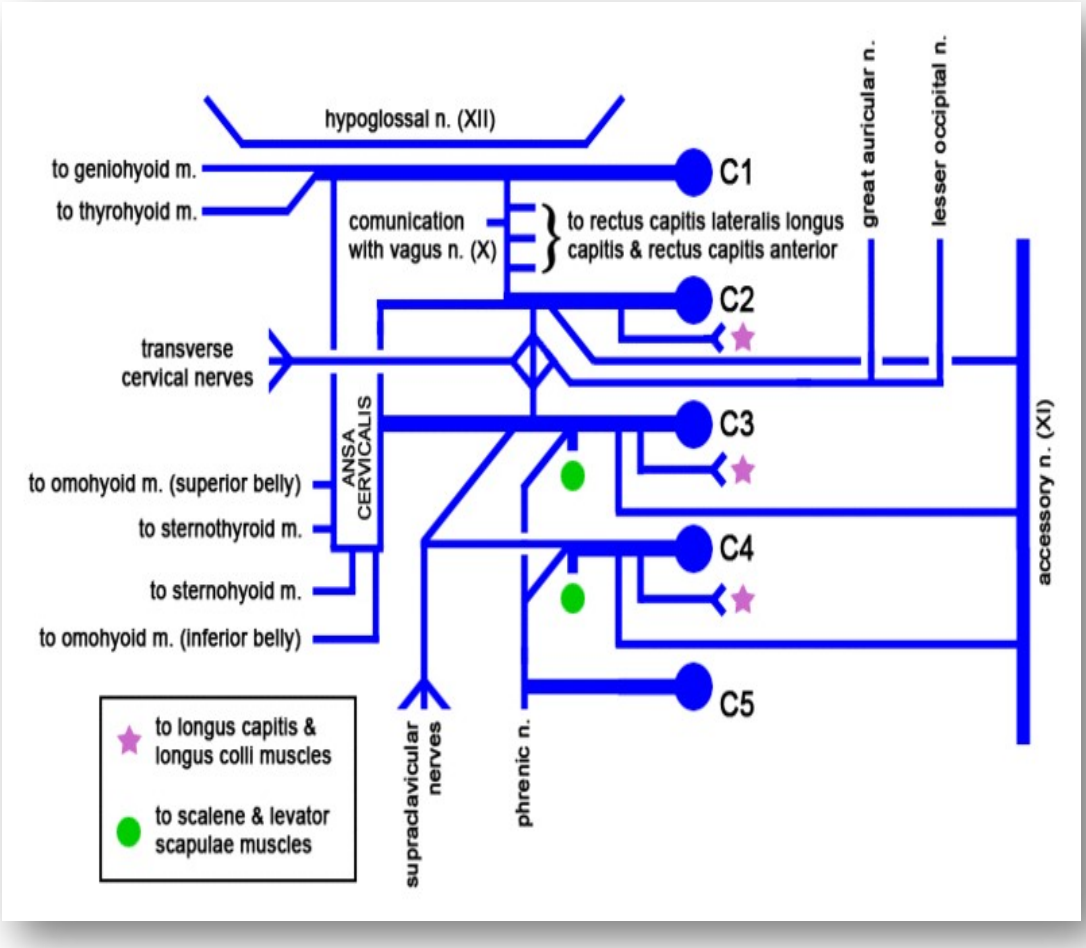
22.Posterior scalene

CERVICAL PLEXUS:



It is plexus of the anterior rami of first four cervical spinal nerves which arise from C1 to C4 cervical segment in the neck. They are located laterally to the transverse processes between prevertebral muscle from the medial side and vertebrae from lateral side. There is anastomosis with accessory nerve, hypoglossal nerve and sympathetic trunk.

It is located deep to the sternocleidomastoid muscle. Nerve formed from the cervical plexus innervates the back of head, as well as some neck muscles.



Branches of cervical plexus

1.Great auricular nerve (C2, C3)

2.Transverse cervical nerve (C2, C3)

3.Lesser occipital nerve (C2)

4.Supraclavicular nerve (C3, C4)

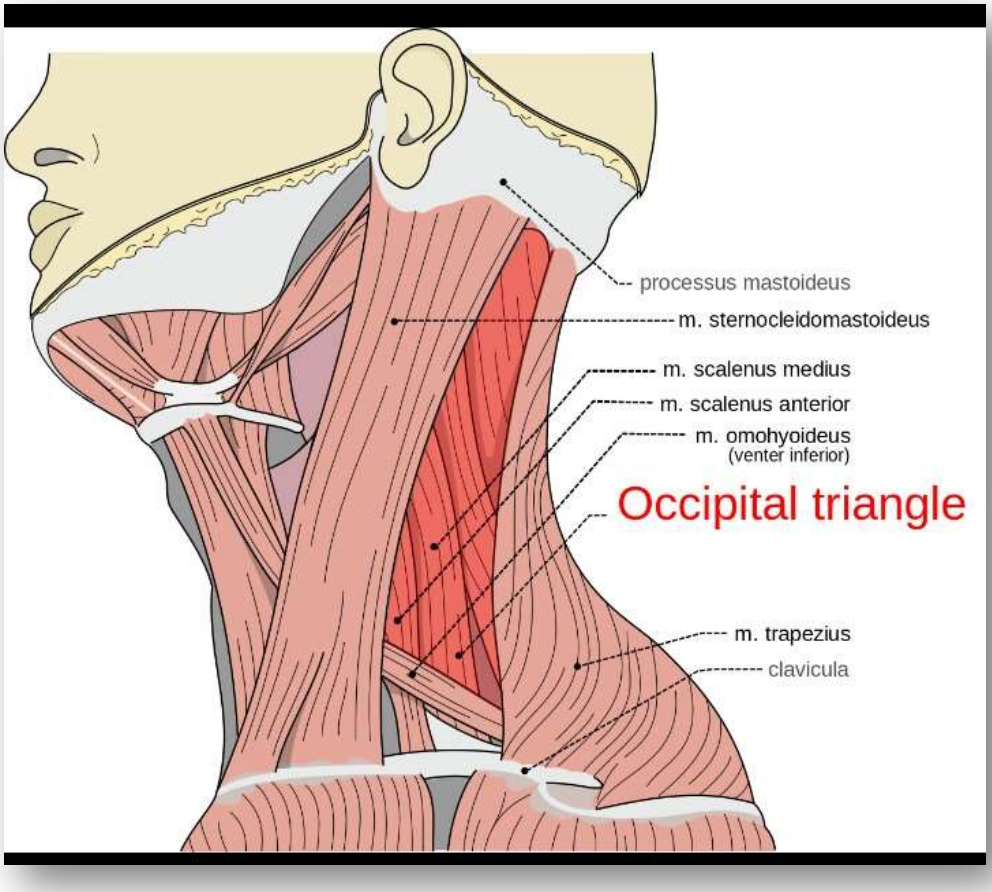
5.Phrenic nerve (C4-C6)

6.Preauricular nerve (posterior root of C2-C3)

7.Postauricular nerve (posterior root of C3-C4)

8.Muscular branches – Ansa cervicalis (C1-C3), Geniohyoid (C1 only), Thyrohyoid (C1 only), Sternohyoid, Sternothyroid, Omohyoid.

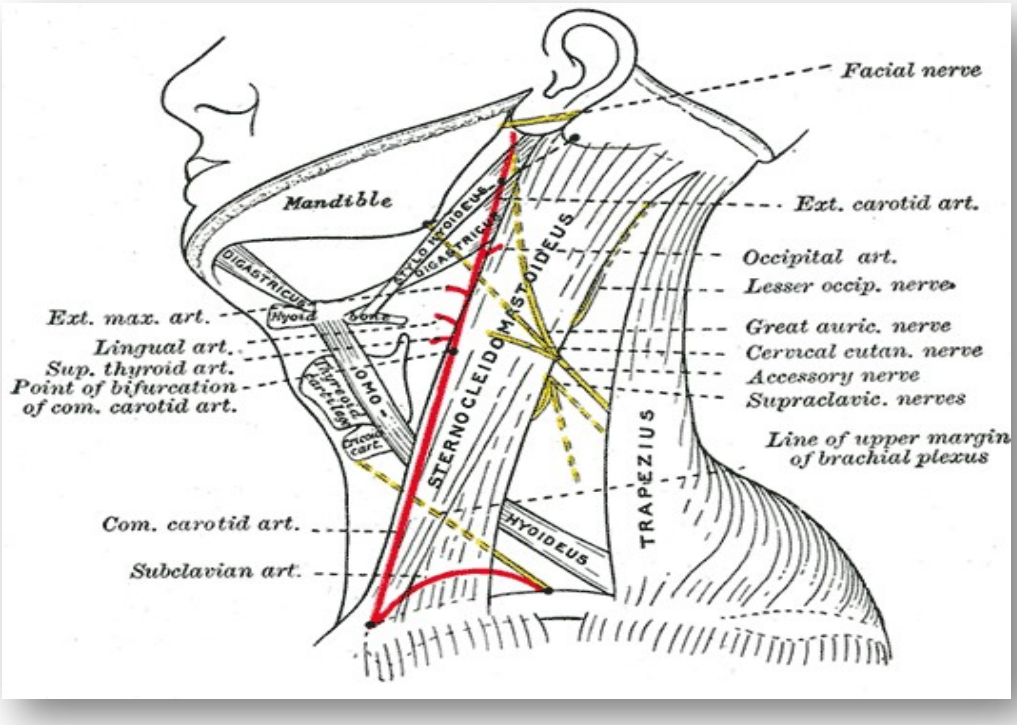
Occipital triangle:



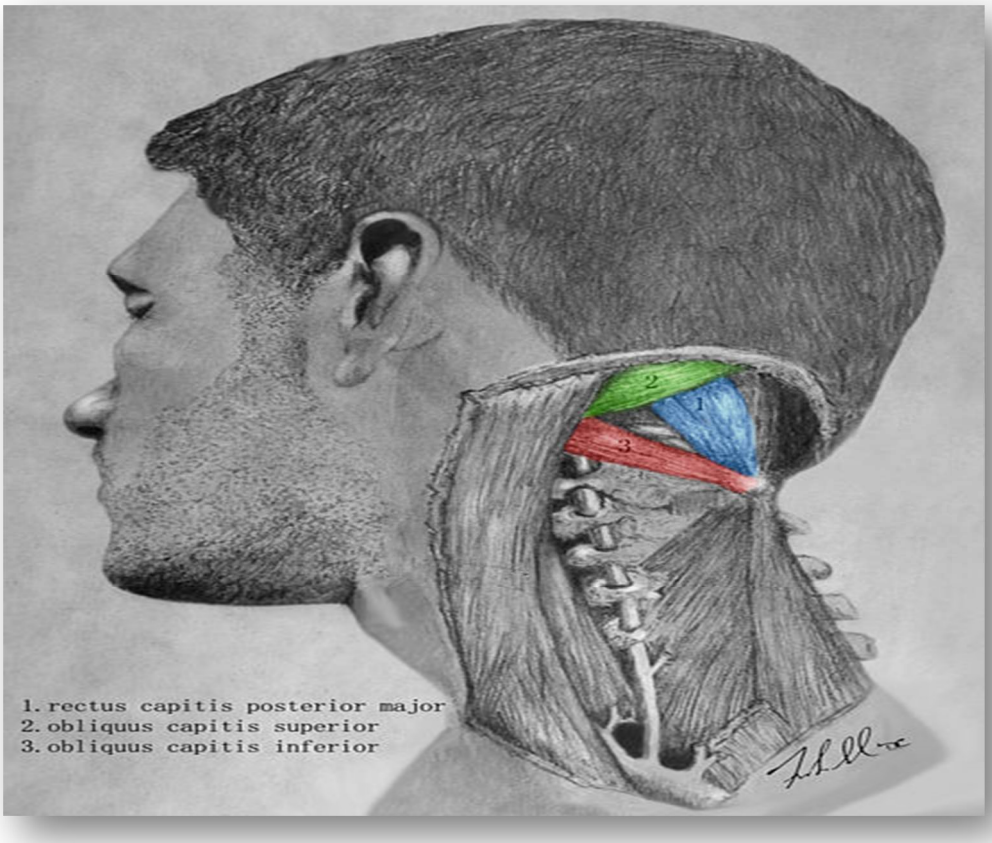
It is the larger division of the posterior triangle. It is bounded in front by the sternocleidomastoid muscle, behind by the trapezius and below by the omohyoideus. Its floor is formed from above downward by spenius capitis, levator scapulae and the sclenius medius and posterior.

It is covered by skin, the superficial and deep fascia and below by the platysma muscle. The accessory nerve is directed obliquely across the space from the sternocleidomastoideus, which it pierces to the under surface of the trapezius below the supraclavicular nerve and the transverse cervical vessel and upper part of the brachial plexus cross the space.

The roof of occipital triangle is formed by the cutaneous nerve of cervical plexus and external jugular vein and platysma muscle. A chain of lymph glands is also found running along the posterior border of sternocleidomastoideus from the mastoid process to the root of the neck.



Suboccipital triangle-



It is a region of the neck bounded by the following three muscles of the suboccipital group of muscles.

1. Rectus capitis posterior major- Above and medially.

2. Obliqus capitis superior- Above and laterally.

3. Oblique capitis inferior- Below and laterally.

It is covered by a layer of dense fibro-fatty tissue, situated beneath the semispinalis capitis. The floor is formed by the posterior atlanto-occipital membrane and the posterior arch of the atlas. In the deep groove on the upper surface of the

posterior arch of the atlas are the vertebral artery and the first cervical or suboccipital nerve.

Containt of the suboccipital triangle.

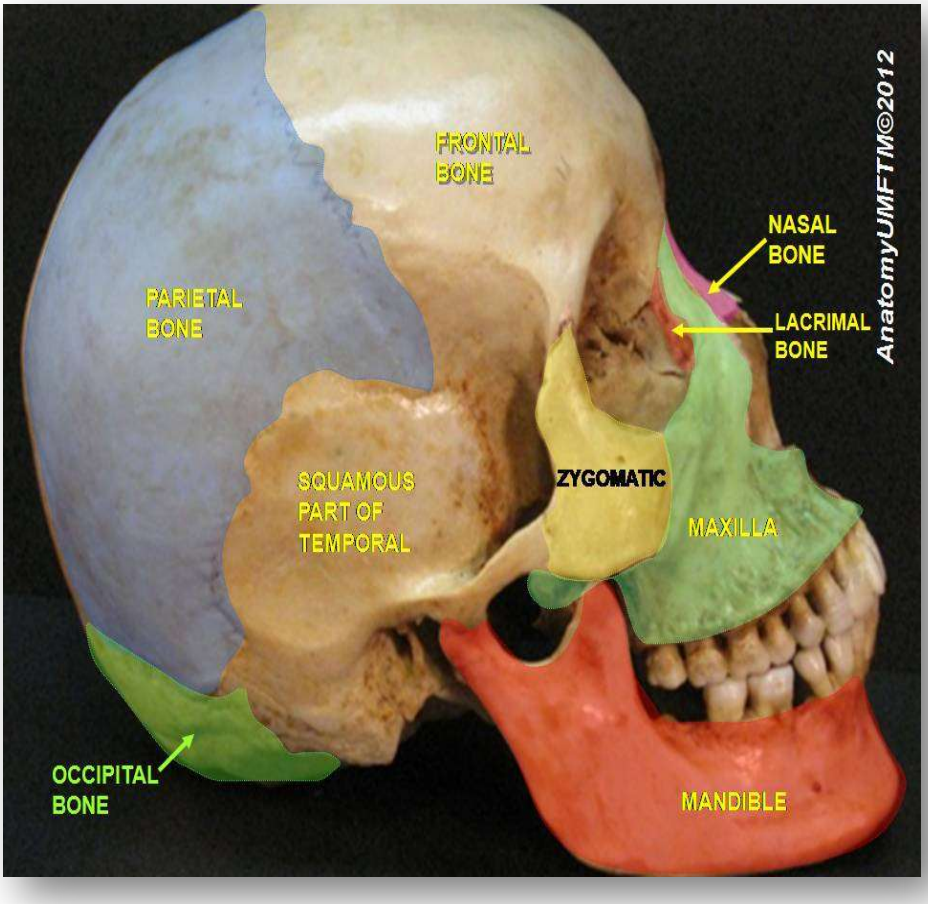
1. Third part of vertebral artery.

2. Dorsal ramus of nerve C1-suboccipital nerve.

3. Suboccipital venous plexus.

The purpose of these muscles is to provide fine motor function in movements of the head. The action of trapezius, sternocledomastoid and other larger muscles that move the head are refined by the relatively small suboccipital triangle muscles.

Occipital bone:



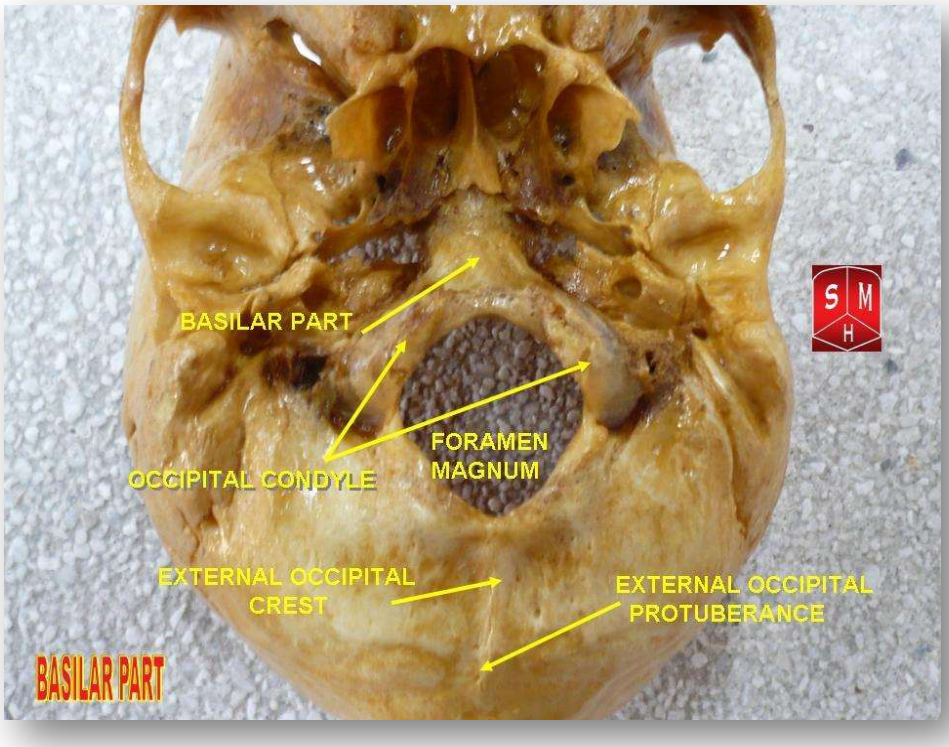
The occipital bone is a cranial dermal bone and it is the main bone of occiput, situated at the back and lower part of cranium. It is a type of flat bone. It is trapezoidal in shape and curved on itself like a shallow dish. The occipital bone overlies the occipital lobes of the cerebrum.

It is pierced by a large oval aperture, the foramen magnum, which allows the passage of the spinal cord through which cranial cavity communicates with the vertebral canal.

It is one of seven bones that fuse together to form skull and is directly next to five of the cranial bones. The foramen magnum allows the medulla oblongata to travel from the brain and connect to the vertebral canal. In addition to the medulla oblongata, the foramen magnum houses the accessory nerves provide nerves to neck and shoulder, the alar ligaments which stabilize the head and neck, and the membrana tectoria ligament that connects the spine to the occipital bone. This collection allows the brain to communicate with the rest of the body via the spine and aids in rotating the head. As a person ages the occipital bone fuses with other bones of cranium. Between the ages of 18 and 25 the sphenoid bone, located in the middle of skull and occipital grow together. The parietal bones at the top of the head and the occipital bone will fuse together later, between the ages of 26 and 40. [37]

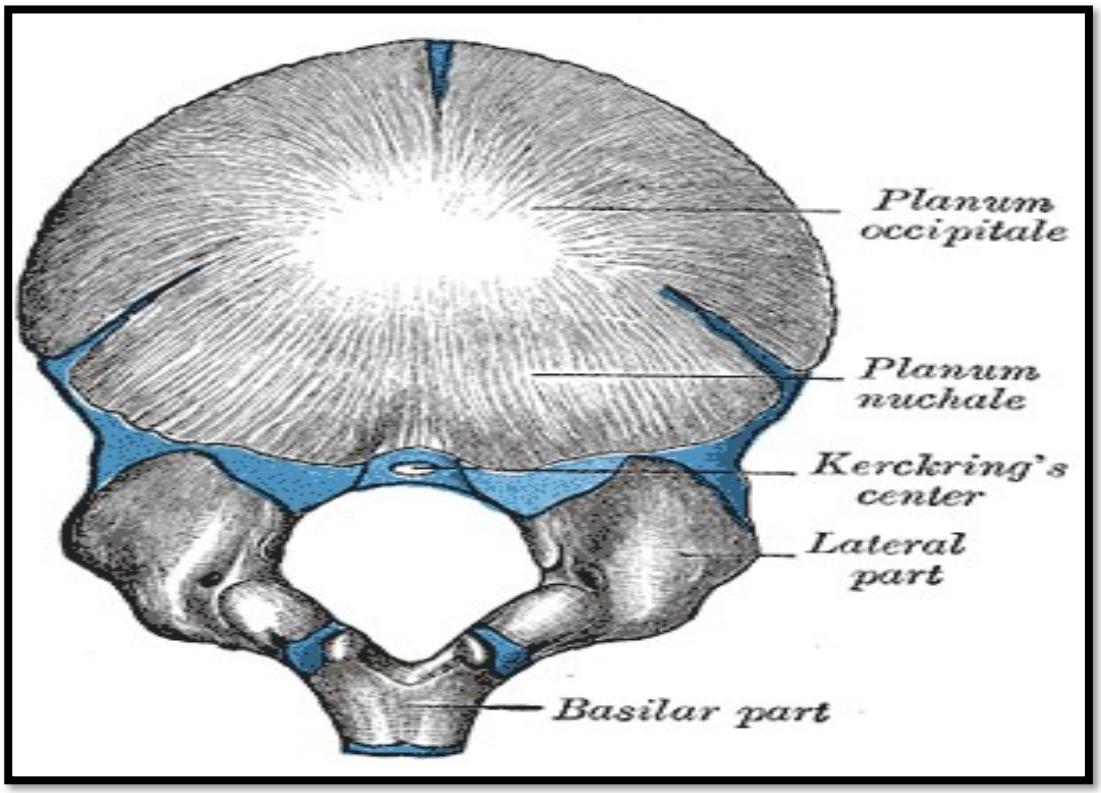
Due to its many attachments and features, the occipital bone is described in terms of separate parts. From its front to back is the basilar part also called as basioccipital, at the sides of foramen magnum are the lateral parts also called the exoccipitals and the back is named as the squamous part. The basilar part is thick, somewhat quadrilateral piece in front of the foramen magnum and directed towards pharynx. This squamous partis the curved, expanded plate behind the foramen magnum is the largest part of occipital bone.

Structure of occipital bone



Occipital bone has inner and outer surface also called plates or tables. Outer surface of the squamous part of occipital there is prominence the external occipital protuberance. The highest point of this is called the inion. From the inion, along the midline of the sqamous partuntill foramen magnum, runs a ridge the external occipital crest also called medial nuchal line and this give attachment to nuchal ligament. Running across the outside of the occipital bone are three curved lines and one line that runs down to the foramen magnum. These are called nuchal line which gives attachment to various ligament and muscles they are called superior and inferior nuchal lines. The inferior nuchal lines run across the midpoint of the medial nuchal lines. The area above the highest nuchal line is termed as occipital plane and the area below this line is termed as nuchal plane.

Development:



The occipital plane of the squamous part of the occipital bone is developed in membrane, and may remain separate throughout life when it constitutes the interparietal bone the rest of bone is developing in the cartilage.

The number of nuclei for the occipital plane is usually given as four, two appearing near the middle line about the second month and two some little distance from the middle line about the third month of fetal life. The nuchal plane of the squamous part is ossified from two centers, which appear about the seventh week of fetal life and soon unite to form a single piece. Union of upper and lower portion of the squamous part takes place in third month of fetal life. An occasional center (kerckring) appears in the posterior margin of the foramen magnum during fifth month, this form a separate ossicle which unites with the rest of the squamous part before birth.

Each of the lateral part begins to ossify from a single center during the eighth week of fetal life. The basilar portion is ossified from two centers, one in front of the other, these appear about the sixth week of fetal life and rapidly coalesce. The occipital bone is said to be ossified from two center and basilar portion from one. About the fourth year the squamous part and two lateral parts unite, by about the sixth year the bone consists of single piece. Between the 18^{th} and 25^{th} year the occipital and sphenoid bone become united, forming a single bone.

Foramen magnum:

The foramen magnum is a large oval foramen longest front to back it is wider behind than in the front where it is encroached upon by the occipital condyles. The clivus, a smooth bony section travel upward on the front surface of the foramen, and the median internal occipital crest travels behind it. Through the foramen passes the medulla oblongata and its membranes, the accessory nerve, the vertebral artery, the anterior and posterior spinal arteries, and the tectorial membrane and alar ligaments.

Angles

- The superior angle of the occipital bone articulates with the occipital angles of the parietal bone and in the fetal skull corresponds in position with the posterior fontanelle.
- The inferior angle is fused with the body of the sphenoid. The lateral angles are situated at the extremities of the groove for the transverse sinuses

Borders

- The superior borders extend from the superior to lateral angle. They are deeply serrated for articulation with occipital border of the parietal and form this union of the lambdoid suture.
- The inferior border extends from the lateral to the inferior angle. The upper half of each articulates with the mastoid portion of the corresponding temporal, the lower half with the petrous part of the same bone. These two portions of the inferior border are separated from one another by the jugular process, the notch on the anterior surface which forms the posterior part of the jugular foramen.[(38)]

DISEASES WHICH CAUSE THE INVOLUNTARY MOVEMENTS OF NECK:

1. SPASMODIC TORTICOLLIS

Definition:- Spasmodic torticollis is an extremely painfull chronic neurological disorder causing the neck to involuntarily turn to the left ,right, upwards and/or downwards. The condition is also referred to as “cervical dystonia”.

Cause:- Causes of the disorder are predominantly idiopathic.

Pathophysiology:-

The pathophysiology of spasmodic torticollis is still relatively unknown. Spasmodic torticollis is considered neurochemical in nature and does not result in structural neurodegenerative changes. Although no lesions are present in the basal ganglia in primary spasmodic torticollis, fMRI & PET studies have shown abnormalities of basal ganglia and hyperactivation of cortical areas. Studies have suggested that there are functional imbalances in the striatal control of globus pallidus, specifically the substantia nigra pars reticulate. The studies hypothesize that hyperactivation of the cortical areas is due to reduced pallidal inhibition of the thalamus; leading to over activity of the medial and prefrontal cortical areas and under activity of the primary motor cortex during movement. It also has been suggested that the functional imbalance is due to an imbalance of neurotransmitter such as dopamine, acetylcholine and gamma aminobutyric acid. These neurotransmitters are secreted from the basal ganglia travelling to muscle groups in the neck. An increase in neurotransmitters causes spasm to occur in neck, resulting in spasmodic torticollis. Studies of local field potentials have also shown an icrease of 4-10Hz oscillatory activity in the globus pallidus internus during myoclonic episodes and an increase of 5-10Hz activity in dystonia muscles when compared to other primary dystonia. This indicates that oscillatory activity in these frequency bands may be involved in the pathophysiology of spasmodic torticollis.

Signs & Symptoms:- Initial symptoms of spasmodic torticollis is usually mild. Some feel an invisible tremor of their head for a few months at onset. Then the head may turn, pull or tilt in jerky movements, or sustain a prolonged position involuntarily. Overtime the involuntary spasm of the neck muscles will increase in frequency and strength until it reaches a plateu. Symptoms also worsen while the patient is walking or during periods of increased stress. Other symptoms include muscle hypertrophy, neckpain, dysarthia and tremor.

Classification:- 1) Primary spasmodic torticollis.

2) Secondary spasmodic torticollis.

According to the head position -

Torticollis is the horizontal turning (rotational collis) of the head and uses the epsilateral splenius and contralateral sternocleidomastoid muscles. This is the 'chin to shoulder' version.

Laterocollis is the tilting of the head from side to side. This is the 'ear to shoulder' version. The muscles involved are ipsilateral, sternocleidomastoid, ipsilateral splenius, ipsilateral scalene complex, ipsilateral levator scapulae and ipsilateral posterior paravertebrals.

The flexion of the neck (head tilts forward) is anterocollis. This is the 'chin to chest' version and is the most difficult version to address. This movement utilizes; the bilateral sternocleidomastoid, bilateral scalene complex, bilateral submental complex.

Retrocollis is the extension of the neck (head tilts back) and bilateral splenius, bilateral upper, bilateral deep post vertebrals. This is the 'chin in the air' version.

Diagnosis: TWSTRS- Toronto western spasmodic torticollis. This is the most common rating scale used to rate the severity of ST. The scale in TWSTRS is divided into three as follows;

A. Severity scale.
B. Disability scale.
C. Pain scale.

1. PARKINSON's DISEASE:

Defintion:- Parkison's disease is a long term degenerative disorder of the central nervous system that mainly affects the motor system. The symptoms generally come on slowly over time. Early in this disease the most obvious are shaking, rigidity, slowness of movement, and difficulty with walking. Thinking and behavioural problems may also occur. Dementia becomes common in more than a third of people with PD. Other symptoms include sensory, sleep, and emotional problems. The main motor symptoms are collectively called "parkinsonism", or a "parkinsoian syndrome".

Causes:- The cause of Parkinson's disease is generally unknown, but believed to involve both genetic and envoirnmental factors. There is also increased risk in people exposed to certain pesticides and among those who have had prior head injuries, while there is a reduced risk in tobacco smokers and those who drink coffee or tea. The motor symptoms of the disease results from the death of cells in the substania nigra, a region of the midbrain. This results in not enough dopamine in these areas. The reason for this cell death is poorly understood, but involves the build-up of proteins into Lewy bodies in the neurons.

Pathophysiology:- The main pathological characteristics of PD are cell death in the brain's basal ganglia(affecting upto 70% of the dopamine secreting neurons in the substania nigra pars compacta by the end of life)and the presence of Lewy bodies(accumulations of the protein alpha-synuclein) in many of the remaining neurons. This loss of neurons is accompanied by the death of astrocytes (star-shaped glial cells) and a significant increase in the number of microglia (another type of glial cell) in the substantia nigra.

There are five major pathways in the brain connecting other brain areas with the basal ganglia. These are known as the motor, occulomotor, associative, limbic and orbitofrontal circuits, with names indicating the main projection area of each circuit. All of them are affected in PD, and their disruption explains many of the symptoms of the disease, since these circuits are involved in a wide variety of functions, including movement, attention and learning. Scientifically, the motor circuit has been examined the most intensively. A particular conceptual model of

the motor circuit and its alteration with Pd has been of great influence since 1980, although some limitations have been pointed out which have led to modifications.

In this model the basal ganglia normally exert a constant inhibitory influence on a wide range of motor systems, preventing them from becoming active at in appropriate times. When a decision is made to perform a particular action, inhibition is reduced for the required motor system, thereby releasing it for activation. Dopamine acts to facilitate this release of inhibition, so high levels of dopamine function tend to promote motor activity, while low levels of dopamine function, such as occur in PD, and demand greater exertions of effort for any given movement. Thus, the net effect of dopamine depletion is to produce hypokinesia, an over all reduction in motor output. Drugs that are used to treat PD, conversely may produce excessive dopamine activity, allowing motor systems to be activated at inappropriate times and thereby producing dyskinesias.

Signs and symptoms :- The most recognizable symptoms in Parkinson's disease are movement(motor) related. Non motor symptoms which include autonomic dysfunction, neuropsychiatric problems (mood, cognition, behavior or thought alterations), and sensory (especially altered sense of smell) and sleep difficulties, are also common. Some of these non-motor symptoms may be present at time of the diagnosis.

Motor symptoms:- Four motor symptoms are considered cardinal in PD: tremor, slowness of movement(bradykinesia), rigidity, and postural instability. The most common presenting sign is a coarse slow tremor of the hand at rest which disappears during voluntary movement of the affected arm and in the deeper stages of sleep. Both hands are affected as the disease progresses. A feature of tremor is *pin-rolling,* the tendency of the index finger and the thumb to touch and perform together a circular movement. Bradykinesia (slowness of movement) is found in every case of PD. Rigidity is stiffness and resistance to limb movement caused by increased muscle tone, an excessive and continuous contraction of muscles. In parkinsonism, the rigidity can be uniform ("lead-pipe rigidity") or ratchet ("cogwheel rigidity"). Rigidity may be associated with joint pain; such paim being frequent initial manifestation of the disease.

In early stages of parkinson's disease, rigidity is often asymmetrical and it tends to affect neck and shoulder muscles prior to the muscles of the face and extremities. With the progression of the disease, rigidity typically affects the whole body and reduces the ability to move.

Dystonia is a well described and frequent symptom in Parkinson's disease. In clinical studies, dystonia has been reported in atleast 30% of patients. Dystonia may precede the classic motor symptom of PD especially in younger patients. In large studies, dystonia was the initial symptom of PD in 5 of 207(2.4%) patients, and for disease onset below 40yrs, the percentage was as high as 14%. Although many cases of dystonia preceding other PD symptoms involve the feet early description of cervical dystonia cases from the prebotulin toxin era has also been reported.

Postural instability and other motor signs and symptoms include gait and posture disturbances such as festination (rapid shuffling steps and a forward flexed posture when walking with no flexed arm swing). Freezing of gait, a slurred monotonous quiet voice, mask like face, and handwriting that gets smaller and smaller are other common signs.

Neuropyschiatric symptoms:-

This includes disorders of cognition, mood, behavior, and thought. The most common cognitive deficit in PD is executive dysfunction, which can include problems with planning, cognitive flexibility, abstract thinking, rule acquisition, inhibiting inappropriate actions, initiating inappropriate actions, working memory and control of attention. Visuospatial difficulties are also part of the disease. Dementia is also associated with a reduced quality of life in people with PD. The dopamine dysregulation syndrome- with wanting of medication leading to over usage is a rare complication of levodopa use. Mood difficulties such as depression, apathy and anxiety are also seen. Upto 30% of people with PD may experience symptoms of anxiety disorders ranging from a generalized anxiety disorder to social phobia, panic disorders and obsessive compulsion disorders. Punding in which complicated repitative aimless stereotyped behaviors occur for many hours is

another disturbance caused by anti Parkinson's medications. Hallucinations or delusions occur in almost 50% of people with PD over the course of illness.

Diagnosis:- A physician will initially assess for Parkinson's disease with a careful medicl history and neurological examination. People may be given levodopa, with any resulting improvement in motor impairment helping to confirm the PD diagnosis. The finding of Lewy bodies in the midbrain on autopsy is usually considered final proof that the person had PD. The clinical course of the illness over time may reveal it is not Parkinson's disease, requiring that the clinical presentation be periodically reviewed to confirm accuracy of the diagnosis.

Other causes that can secondarily produce Parkinsonism are stroke and drugs. Parkinson plus syndromes such as progressive supra nuclear palsy and multiple system atrophy must be ruled out. Anti Parkinson's medications are typically less effective at controlling symptoms in Parkinson plus syndromes. Faster progression rates, early cognitive dysfunction or postural instability, minimal tremor or symmetry at onset may indicate a Parkinson plus disease rather than PD itself. Genetic forms with an autosomal dominant or recessive pattern of inheritance are sometimes reffered to as familial Parkinson's disease or familial Parkinsonism.

The most widely known diagnostic criteria come from the UK Queen Square Brain Bank for Neurological Disorders and the U.S. National Institute of Neurological Disorders and Stroke. The Queen Square Brain Bank criteria require slowness of movement (bradykinesia) plus either rigidity, resting tremor, or postural instability. Other possible causes of these symptoms need to be ruled out. Finally, three or more of the following supportive features are required during onset or evolution: unilateral onset, tremor at rest, progression in time, asymmetry of motor symptoms, and response to levodopa for at least five years, clinical course of at least 10 years and appearance of dyskinesis induced by the intake of excessive levodopa.

Imaging:- Computed tomography(CT) scans of people usually appear normal. MRI has become more accurate in diagnosis of the disease over time, specifically through iron sensitive T2* and SWI sequences at a magnetic field strength of at least 3T, both of which can demonstrate absence of the characteristic 'swallow tail' imaging pattern in the dorsolateral substantia nigra. CT and MRI are

also used to rule out diseases that can be secondary causes of Parkinsonism, most commonly encephalitis and chronic ischemic insults, as well as frequent entities such as basal ganglia tumors and hydrocephalus.

Dopamine related activity in the basal ganglia can be directly measured with PET and SPECT scans.

2. SPINOCEREBRAL ATAXIA WITH CERVICAL DYSTONIA.

Definition:- Spinocerebral ataxia(SCA) also known as spinocerebellar atrophy or spinocerebellar degeneration is a progressive, degenerative ,genetic disease with multiple types each of which could be considered as a neurological condition in its own right. The disease is caused by either a recessive or dominant gene.

Cause:- The hereditary ataxia are categorized by mode of inheritance and causative gene or chromosomal locus. The hereditary ataxias can be inherited in autosomal dominant, autosomal recessive or X-linked manner. Synonyms for autosomal dominant cerebellar ataxias used prior to the current understanding of the molecular genetics cure Marie's ataxia, inherited olivo pontocerebellar atrophy, cerebello olivary atrophy, or the more generic term spino cerebeller degeneration.

There are five typial autosomal- recessive disorders in which ataxia is a prominent feature; Friedreich ataxia, ataxia telangiectasia, ataxia with vit E deficiency, ataxia with oculomotor apraxia (AOA), spastic ataxia. Several types of SCA are characterized by repeat expansion of the trinucleotide sequence CAG in DNA that encodes a polyglutamine repeat tract in protein. The expansion of CAG repeats over successive generation appears to be due to slipped strand mispairing during DNA replication or DNA repair.

Signs and symptoms:- Spinocerebellar ataxia(SCA) is one of a group of genetic disorders characterized by slowly progressive in co-ordination of gait and is often associated with poor co-ordination of hands, speech and eye movements. A review of different clinical features among SCA subtypes was recently published describing the frequency of non cerebellar features like Parkinsonism, chorea, pyramidalism, cognitive impairment, peripheral neuropathy, seizures among others. As with other forms of ataxia, SCA frequently results in atrophy of the cerebellum,

loss of fine co-ordination of muscle movements leading to unsteady and clumpsy motion and other symptoms.

In an article related to slowly progressive cerebellar ataxia and cervical dystonia they have described five cases with a rare combination of young onset, slowly progressive cerebellar ataxia and cervical dystonia. Two were sporadic, whereas the other three were familial including two from one family. The age of onset of these cases were between 16 to 37yrs. The presenting symptom was cervical dystonia and/or dystonic head tremor in three patients and hand or lower limb tremor in two. In two cases cervical dystonia and/or dystonic head tremor developed approximately 6 to 10 years before cerebellar dysfunctions and in three they developed at the same time. A literature search showed 10 cases of cervical dystonia associated with genetically proven spinocerebellar ataxia (SCA).

The symptoms of an ataxia vary with the specific type and with the individual patient. In general, a person with ataxia retains full mental capacity but progressively loses physical control.

Classification and Diagnosis:- A few SCAs remains unspecified and cannot be precisely diagnosed, but in the last decade genetic testing has allowed precise identification of dozens of different SCAs and more test being added each year.

In 2008, agenetic ataxia blood test developed to test for 12 types of SCA. MRI scanning of brain and spine and spinal tap.

SCA types:- SCA1, 2, 3 etc atleast 29 different gene mutations that have been found

3. HUNTINGTON's DISEASE.

Definition:- Huntington's disease is an incurable, hereditary brain disorder. It is devastating disease that causes damage to brain cells, or neurons. The disease happens when a faulty gene makes an abnormal version of the Huntingtin protein. As parts of the brain deteriorate, this affects movement, behavior, and cognition. It becomes harder to walk, think, reason, swallow, and talk.

Causes:- HD is caused by a faulty gene(mhTT) on chromosome number 4.

A normal copy of the gene produces hutingtin, a protein. The faulty gene is larger than it should be. This leads to excessive production of cytosine, adenine, and guanine (CAG), the building blocks of DNA. Normally, CAG repeats between 10 and 35 times, but in HD, it repeats from 36 to 120 times. If it repeats 40 times or more, symptoms are likely.

This change results in a larger form of huntingtin. This is toxic, and as it accumulates in the brain, it causes damage to brain cells. Some of the brain cells are sensitive to the larger form of huntingtin, especially those related to movement, thinking, and memory. It undermines their function and eventually destroys them.its cause is unknown.

Signs and symptoms:- Signs and symptoms are most likely to appear between the ages of 30 and 50 years, but they can occur at any age. They tend to worsen over 10 to 20 years. The key symptoms are:

1) Personality changes, mood swings, and depression.

2) Problems with memory and judgement.

3) Unsteady walk and uncontrollable movements.

4) Difficulty in speaking and swallowing, and weight loss.

Early signs and symptoms include:

1) Slight uncontrollable movements.
2) Small changes in co ordination and clumsiness.
3) Stumbling.
4) Slight signs of mood and emotional change.
5) Lack of focus, slight concentration problems and difficulty in functioning, for example at work.
6) Lapses in short term memory
7) Depression
8) Irritability.

The middle and later stages: These include physical changes, loss of motion control, and emotional and congnitive changes.

Physical changes include:

1) Difficulty speaking, including looking for words and slurring.
2) Weight loss, leading to weakness.
3) Difficulty eating and swallowing, as the muscles in the mouth and diaphragm may not work properly.
4) Risk of chocking, especially in the later stages.
5) Uncontrollable body movements.

There may be uncontrollable body movements, including:

1) Uncontrollable movements of the face.
2) Jerking of parts of the face and the head.
3) Flicking or fidgety movements of the arms, legs and body.
4) Lurching and stumbling.

Cervical dystonia –CD is an abnormal, involuntary movement disorder that occurs in about 14% of patients with HD. Although CD is often one of the initial symptoms of juvenile Huntingtong's disease. It is considered to be atypical in the early stages of adult onset. The first case of adult, onset HD revealed by CD was reported by Ashizawa and Jankovic.

Other emotional changes include:

1) Aggression.
2) Anger.
3) Antisocial behavior.
4) Apathy.
5) Depression.
6) Excitement.
7) Frustration.
8) Lack of emotion becomes more apparent.
9) Moodiness, Stubbornness, Cognitive changes.

Diagnosis :- The doctor will examine the patient and ask about family and medical history, and symptoms, such as recent emotional changes. Imaging tests, such as a CT or MRI scan, are sometimes used to identify changes in the patient's brain structure, and to rule out other disorders. Genetic testing may be recommended to confirm a diagnosis.

4. ESSENTIAL TREMOR

Definition:- Essential tremor(ET, also referred to as benign tremor, familial tremor, or idiopathic tremor) is a progressive neurological disorder that is also the most common movement disorder. The cause of the condition is currently unknown. It typically involves a tremor of the arms, hands or fingers but sometimes involves the head, vocal cords or other body parts during voluntary movements such as eating and writing.

It is distinct from Parkinson's disease and often misdiagnosed as such although some individuals have both conditions. Essential tremor is commonly described as action tremor (that is it intensifies when one tries to use the affected muscles) or postural tremor (that is present with sustained muscle tone) rather than a resting tremor such as is seen in Parkinson's which is usually not included among its symptoms.

Cause:- The underlying cause of essential tremor is not clear but many cases seem to be familial. Approximately one – half of the cases are due to genetic mutation and the pattern of inheritance is most consistent with autosomal dominant transmission. No genes have been identified yet but genetic linkage has been established with several chromosomal regions.

A number of environmental factors, including toxins, are also under active investigation as they may play a role in the disease's cause. Harmane or harmaline has been implicated not only in essential tremors, but is also found in greater quantities in the brain fluid of Parkinson's disease sufferers as well as cancer. Higher levels of the neurotoxin are associated with greater severity of the tremors. Exposure is primarily found from the meat consumption of beef, pork, and especially chicken, even when cooked. Indeed, the greatest meat consumers were significantly more likely to have essential tremor. Harmaline's high lipid solubility enables accumulation in the brain tissue upon consumption from these envoirnmental sources.

Patho physiology:- In terms of patho physiology, clinical, physiological and imaging studies point to an involvement of the cerebellum and/or cerebellothalamocortical circuits. Changes in the cerebellum could also be mediated by alchoholic beverage consumption. Purkinje cells are especially susceptible to ethanol excitotoxicity. Impairment of Purkinje synapses is a component of cerebellar degradation that could underlie essential tremor. Some cases have Lewy bodies in the locus ceruleus.

ET cases that progress to Parkinson's disease are less likely to have had cerebellar problems that progress to Parkinson's disease are less likely to have had cerebellar problems.

Recent post mortem studies have evidenced alterations in LINGO1 (Leuine rich repeat and Ig domain containing 1) gene and GABA receptors in the cerebellum of people with essential tremor. HAPT1 mutations have also been linked to ET, as well as to Parkinson's disease, multiple system atrophy, and progressive supra nuclear palsy.

Signs and symptoms:- In mild cases, ET can manifest as the inability to stop the tongue or hands from shaking, the ability to sing only in vibrato, and difficulty doing small precise tasks such as threading a needle. Even simple tasks like cutting in a straight line or using a ruler can range from difficult to impossible, depending on the severity of the condition. In disabling cases, ET can interfere with a person's activities of daily living, including feeding, dressing, and taking care of personal hygiene. Essential tremor generally presents as rhythmic tremor(4-12Hz) that occurs only when the affected muscle is exerting effort. Any sort of physical or mental stress will tend to make tremor worse.

The tremor may also occur in the head(neck), jaw and voice as well as other body regions, with the general pattern being that the tremor begins in the arms and then spreads to these other regions in some people. Women are more likely to develop the head tremor than are men.

Other types of tremor may also occur including postural tremor of the outstretched arms, intention tremor of the arms and rest tremor in the arms. Some people may have unsteadiness and problems with gait and balance.

ET related tremors do not occur during sleep, but people with ET sometimes complain of an especially coarse tremor upon awakening that becomes noticeably less coarse within the first few minutes of wakefulness. Tremor and disease activity/intensity can worsen in response to fatigue, strong emotions, low blood sugar, cold and heat, caffeine, lithium salts, some antidepressants, and other factors. It is typical for the tremor to worsen in "performance" situations, such as when writing a check for payment at a store or giving a presentation.

Parkinson's disease and Parkinsonism can also occur simultaneously with ET. A study found that the degree of tremor, rigidity, and functional disability did not differ from patients with idiopathic Parkinson's disease. Hand tremor predominated (as it did in Parkinson's disease), and occurred in nearly all cases, followed by head tremor, voice tremor, neck, face, leg, tongue and trunk tremor. Most other tremors occurred in association with hand tremor. Another study found more severe tremors, a lower sleep disorder, a lower sleep disorder frequency, and a similar prevalence of other non motor symptoms.

Walking difficulties in essential tremor are common. About half of patients have associated **dystonia**, including **cervical dystonia**, writer's cramp, spasmodic dysphonia, and cranial dystonia, and 20% of the patients had associated Parkinsonism. Olfactory dysfunction (loss of sense of smell) is common in Parkinson's disease, and has also been reported to occur in patients with essential tremor. A number of patients with essential tremor also exhibit many of same neuropsychiatric disturbances seen in idiopathic Parkinson's disease.

Diagnosis:- Usually the diagnosis is established on clinical grounds. Tremors can start at any age, from birth through advanced ages (senile tremor). Any voluntary muscle in the body may be affected, although the tremor is most commonly seen in the hands and arms and slightly less commonly in the neck (causing the person's head to shake), tongue and legs. A resting tremor of the hands is sometimes present. Tremor occurring in the legs might be diagnosable as orthostatic tremor.

5. CHOREA

Definition:- Chorea is a movement disorder that causes involuntary, unpredictable body movements. Chorea symptoms can range from minor movements, such as fidgeting, to severe uncontrolled movements of the arms and legs. It can also interfere with speech, swallowing, posture and gait.

Causes and symptoms:- Chorea symptoms usually depend upon the condition causing it. A common symptom is "milkmaid's grip." People with this condition don't have strong hand muscles and will squeeze and release their hand, as if milking. Another symptom is involuntarily sticking out the tongue.

Chorea symptoms can be fast or slow. A person may appear to be writing in pain and have no bodily control.

Conditions associated with chorea and its symptoms include:

Huntington's disease

Huntington's disease is an inherited disease. It causes the breakdown of nerve cells in your brain. People with Huntington's disease can experience chorea symptoms such as involuntary jerking or writhing. Milkmaid's grip is also a common symptom. Chorea is more common in people with adult-onset Huntington's disease. Overtime, symptoms may get worse and movements may affect the legs and arms.

Chorea-acanthocytosis

This condition is a very rare genetic disorder. It's characterized by misshapen red blood cells. It causes neurological abnormalities and affects brain functioning. Chorea for this condition commonly involves abnormal arm and leg movements, shoulder shrugs, and pelvic thrusts. It can also involve rapid, purposeless movements of the face.

People with this form of chorea can also exhibit dystonia. This is characterized by involuntary muscle contractions of the mouth and face, such as:

1) Teeth grinding
2) Involuntary belching
3) Drooling or spitting

4) Lip and tongue biting
5) Difficulty with speech or communication
6) Vocal tics, such as grunting, involuntary speaking, or slurred speech.

Sydenham's chorea

This condition mainly affects children and adolescents, and follows a streptococcal infection. It can also be complication of rheumatic fever. This type of chorea mainly affects the face, arms, and hands. It can impede voluntary movements, making it difficult to perform basic tasks such as getting dressed or feeding yourself.

It can also lead to:

1) Frequently dropping or spilling items
2) Abnormal gait
3) Muscle weakness
4) Slurred speech
5) Diminished muscle tone

People with chorea type often display milkmaid grip. Another common symptom is called "harlequin tongue." When a person with this symptom tries to stick their tongue out, the tongue pops in and out instead.

Other causes -

1) AIDS
2) Genetic conditions, such as Huntington's disease
3) Immune conditions such as systemic lupus erythematosus
4) Infection-related conditions such as Sydenham's chorea
5) Medications, including levodopa and neuroleptics
6) Metabolic or endocrine disorders, including hypoglycemia
7) Pregnancy, known as chorea gravidarum

Diagnosis

Because many conditions cause chorea, your doctor must take a thorough medical history to determine potential causes. To diagnose chorea, your doctor may ask;

1) When did the symptoms begin?
2) What makes the symptoms better or worse? Do your chorea symptoms tend to worsen when you're stressed?
3) Do you have a family history of hyperthyroidism or Huntington's disease?
4) What medications are you taking?

Lab tests such as a low copper level in your body can indicate Wilson disease, a genetic disorder that causes chorea. Test for spiky erythrocytes or red blood cells can indicate chorea-acanthocytosis. Blood tests for parathyroid hormones or thyroid hormones can indicate metabolic endocrine- related chorea.

6. TARDIVE DYSTONIA

Definition:- Dystonia is a neurological movement disorder where uncontrollable and sometimes painful muscle spasms are caused by incorrect signals from the brain. The condition results in abnormal postures or movements, with or without tremor.

Dystonia has a variety of causes one of which is an unwanted side effect of taking certain drugs used to treat other conditions. Where dystonia is caused by the side effects of drugs in this manner, this is called tardive dystonia.

There are number of different types of involuntary muscle activity that results from neurological conditions caused by the side effects of drugs. As a group, these are called tardive dyskinesias. Tardive dystonia is one type of tardive dyskinesia in which the involuntary movements tend to be slow and writing. Other types of tardive dyskinesia include facial tics and irregular, dance like movements called choreas.

Cause:- Tardive dystonia is most commonly the result of side effects from a type of drug which is prescribed to treat schizophrenia and psychosis called a 'dopamine receptor blocker'(DRB). In recent years DRBs have been improved to reduce the risk of causing tardive dystonia but unfortunately some risk still remains. Some DRBs are used to treat nausea and dizziness, not psychosis.

Signs and symptoms;- Tardive dystonia is more taxing condition as it can be permanent. It is caused only by DRBs and usually only after people have taken the drugs for months or even years.

Symptoms include: One or more involuntary movements of the face and/or mouth (oromandibular dystonia), involuntary eye closure (blepharospasm), voice problems, involuntary twisting or movement of the neck (cervical dystonia) and contortion of the trunk and limbs. Occasionally, symptoms do disappear but unfortunately this is rare (around 1 in 10). Research suggests that, if the drug causing the tardive dystonia has been stopped only a short period of time, remission of symptoms is more likely than if the drug has been taken for a longer period.

Acute dystonic reaction In most important cases of tardive dystonia, the symptoms of tardive dystonia tend to be acute but short lived. This is called an acute dystonic reaction. Such reactions usually affect the face causing strange movements of the face and/or mouth.

In some but not all cases, the movements can cause problems with eating and swallowing (such movements are called oromandibular dystonia). It may also cause hyper-extension of the spine amongst other effects. It is important for the patient to continue taking DRB drugs then the physician would be expected to look for different types of DRB drugs that hopefully will not cause acute dystonic reaction.

Many other drugs have been reported to cause acute dystonic reactions including anti- depressants of the type that inhibit the reuptake of serotonin, calcium antagonists (sometimes used to treat high blood pressure and angina), some anaesthetic agents, anticonvulsants such as carbamazepine and phenytoin and even illicit drugs such as cocaine and ecstasy.

Diagnosis:- TD can be hard to diagnose. Symptoms might not appear until months or years after you start taking antipsychotic medicine. Or you might first notice the movements after you have already stopped taking the drug. The timing can make it hard to know whether the medicine caused your symptom

If u takes medicine for mental health conditions your doctor should check you atleast once a year to make sure you don't have TD. He can give you a physical exam test called the Abnormal Involuntary Movement Scale.

He can also do tests to find out whether you have another disorder that causes abnormal movements like:

1) Cerebral palsy
2) Huntington's disease
3) Parkinson's disease
4) Stroke
5) Tourette's syndrome.

7. TOURETTE SYNDROME

Definiton:- Tourette (too-RET) syndrome is a disorder that involves repetitive movements or unwanted sounds(tics) that can't be easily controlled. For instance, you might repeatedly blink your eyes, shrug your shoulders or blurt out unusual sounds or offensive words.

Tics typically show up between ages 2 and 15, with the average being around 6years of age. Males are about three to four times more likely than females to develop Tourette syndrome.

Cause:- The exact cause of Tourette syndrome isn't known. It's a complex disorder likely caused by a combination of inherited (genetic) and envoirnmental factors. Chemicals in the brain that transmit nerve impulses (neurotransmitters), including dopamine and serotonin, might play a role.

Risk factors:-

Risk factors for Tourette syndrome include:

1) **Family history.** Having a family history of Tourette syndrome or other disorders might increase the risk of developing Tourette syndrome.

2) **Sex.** Males are about three to four times more likely than females to develop Tourette syndrome.

Symptoms:- Tics – sudden, brief, intermittent movements or sounds- are the hallmark sign of Tourette syndrome. They can range from mild to severe. Severe symptoms might significantly interfere with communication, daily functioning and quality of life.

Tics are classified as:

1) Simple tic: These sudden, brief and repetitive tics involve a limited number of muscle groups.
2) Complex tics: These distinct, co-ordinated patterns of movements involve several muscle groups.

Tics can also involve movement (motor tics) or sounds (vocal tics) Motor tics usually begin before vocal tics do. But the spectrum of tics that people experience is diverse.

Common motor tics seen in Tourette syndrome

Simple tics	**Complex tics**
Eye blinking.	Touching or smelling objects.
Head jerking.	Repeating observed movements.
Shoulder shrugging.	Stepping in a certain pattern.
Eye darting.	Obscene gesturing.
Nose twitching.	Bending or twisting
Mouth movements.	Hoping.

Common vocal tics seen in Tourette syndrome.

Simple tics	**Complex tics**
Grunting.	Repeating one's own words/phrases.
Coughing.	Repeating other's words or phrases.
Throat clearing.	Using vulgar, obscene or swear words.
Barking.	

In addition, tics can:

1) Vary in type, frequency and severity.
2) Worsen if you're ill, stressed, anxious, tierd or excited.
3) Occur during sleep.
4) Change over time.
5) Worsen in the early teenage years and improve during the transition into adulthood.

Before the onset of motor or vocal tics, you'll likely experience an uncomfortable bodily sensation (premonitory urge) such as an itch, a tingle or tension. Expression of the tic brings relief. With great effort, some people with Tourette syndrome can temporarily stop or hold back a tic.

Diagnosis:- There's no specific test that can diagnose Tourette syndrome. This diagnosis is based on the history of your signs and symptoms.

The criteria used to diagnose Tourette syndrome include:

1) Both motor tics and vocal tics are present, although not necessarily at the same time.
2) Tics occur several times a day, nearly every day or intermittently, for more than a year.
3) Tics begin before the age of 18.
4) Tics aren't caused by medications other substances or another medical condition.
5) Tics must change overtime in location, frequency, type, complexity or severity.

A diagnosis of Tourette syndrome might be overlooked because the signs can mimic other conditions. Eye blinking might be initially associated with vision problems, or sniffling attributed to allergies.

Both motor and vocal tics can be caused by conditions other than Tourette syndrome. To rule other causes of tics, your doctor might recommend:

1) Blood tests
2) Imaging studies such as an MRI.

PREVIOUS WORK DONE

1) Study of vaikalyakara marma w.s.r.to orthopedic traumas –

Vd. Tiwari S.P, Lucknow University.[39]

2) A study of sandhi marma (janu marma) with reference to intensity and mode of trauma – Vd. Raipa usha Lucknow University.[40]

3) Marma ke pariprekshya mein vaikalyakara marma ka adhyayana –Vd. Mishra kamlesh, Jaipur university.[41]

4) Urdhva-shakhagata vaikalyakara marma: Ek Rachanatmaka Adhyayana – Vd. Borkar B.A. Nagpur University.[42]

5) Kakshadhara marmacha Rachanatmaka abhyasa tasya vaikalyakarattva pareekshana – Vd. Nehare r.k, Nanded University.[43]

6) Vaikalyakara marma vichara visheshtaha koorpara marma vaikalyakarattva abhyasa – Vd. Mule S.K., Nanded University.[44]

MATERIALS & METHODS

The study will be conducted in following 2 phases.

a) Conceptual study :-

A thorough review of literature regarding concept of krukatika marma, sandhi marma as a vaikalyakara marma is collected from all ayurvedic text, morden text and work done by other ayurvedic scholars.

b) Clinical study :-

Clinical study is conducted on '100' samples (Patients) of Involuntary Movements (Chal-Murdhataa Lakshana) WSR head.

C. OBSERVATIONAL STUDY:

Study type :-

It is Retrospective, Observational study.

Location of study:-

Ayurved hospital and other hospitals OPD/IPD.

Duration of study:-

The study is conducted during the schedule course of Ph. D.

Clinical study plays an important role in establishing a fact which is theoretically written in our texts. For this purpose, hundred (100) patients of Diagnosed Cervical spondylosis were selected from OPD/IPD and observed.

Study design:

Retrospective, Observational study.

⇩

Diagnosed patient of Chal murdhata were selected.

⇩

History of patient will be taken.

⇩

Assessment H/O of any trauma, Accident, occupation in age group 18-70 years.

⇩

Result drawn from assessment of Chalmurdhta patient described in the final Dissertation.

Methods of selection of study subject (selection criteria):

Inclusion Criteria:-

1. Both genders.
2. Age from 18 to 70 years.
3 100 patients of Involuntary Movements (*Chal Murdhata Lakshana*) WSR head.

Exclusion Criteria:-

1. Patients of Parkinsonism are excluded from this study to avoid bias of this study.

Operational definition: -

1. *Krukatika marma* –

Krukatika marma is *vaikalyakara* and *sandhi marma* and situated at atlanto-axial joint so that any weight bearing load on head affects atlanto-axial joint that means *krukatika marama* & that may lead to causes disability.

2. *Chal murdhata* –

Means Involuntary movements of head. In this modern era stressful & strainful activities, improper work habits cause excessive strain on joints, ligaments of atlanto-axial joint which produces inflammatory changer along with rupture of muscle fibres resulting in to restricted movement of Neck along pain & acute tenderness chalamurdhata of neck.

Criteria of assessment:

The criteria of assessment of data is based on following parameters,

A. Subjective Parameters:-

Involuntary Movements (*Chal-Murdhataa Lakshana)* WSR head and other *granthokata* symptoms of *krukatika marma vidhya lakshana* have seen.

B. Objective Parameters :-

1. X-Ray of Cervical region- AP, Lateral view.

RESEARCH METHODOLOGY SPECIFIED & EXPLAINED FOR DATA COLLECTION.

Sample size:

Calculation of sample size by Dennil 1999

$n = z^2*p*(1-p)/d^2$

Where

z = 1.96 statistical level of significance.

P = 20%. Highest prevalence = 0.20

(1-p) = 1-0.2 = 0.8

d = allowable error 10%.

Hence d = 0.1

$N= (1.96)^2*0.2*0.8/ (0.1)^2 = 61.46$

For the statically point of view total 100 patient will be taken.

Sampling technique:

Random method of selection. (Patients were selected on the basis of inclusive and exclusive criteria)

Study instruments/data collection tool:

1. **Literature:** Considering the aim of anatomical study of *Krukatika marma, Vaiklakar Marma,* and *Chalmurdhta viddha lakshana* of *Krukatika marma,* review of Ayurvedic literature, Text book, Refrence book, and websites includes.

2. Radiological study. (**X-Ray** report).

Data management & analysis procedure:

Maintained case record forms and the data observed after study are the source of data collection.

Data obtained from the study is Qualitative type of data. It is reveal in observation section of the study. To analyse the qualitative data ‘Chi-square test’ was applied.

Obtained result mention in observation section.

OBSERVATIONS

Observations:-

- As this is an observational descriptive type of study i.e. Cross Sectional Study.
- Present study carried out in single group.
- There is no gradation in subjective & objective parameter.
- Therefore, the collected study data is presented according to descriptive statistical rules.

e. g. Tables, Graphs, Percentage etc.

In this study patients with *Chalmurdhta* were observed in the OPD/ IPD at our institute and orthopedic hospitals and 100 patients of *Chalmurdhta* according to the inclusion criteria were selected and observed for anatomical study.

Sample no of patients observed = 110

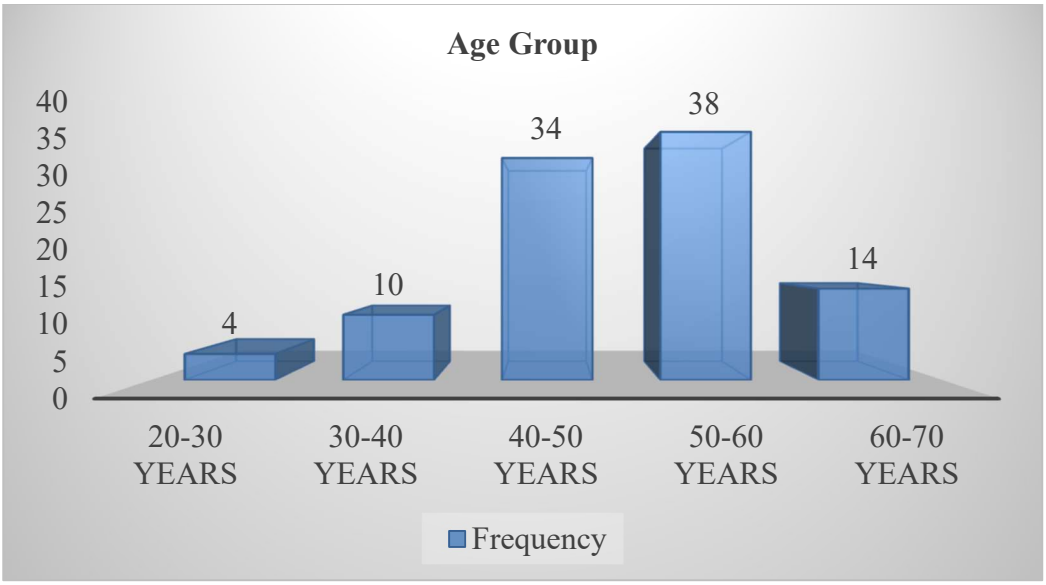
Total no of patients included = 100

Total number of patients excluded = 10

Reason for exclusion-

1. Not fulfill age criteria.

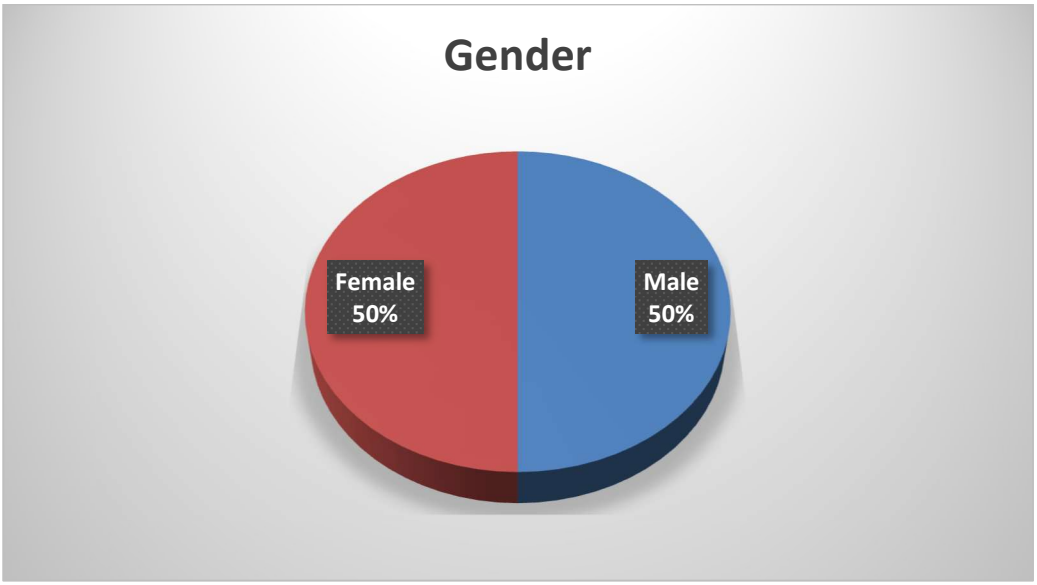
Table 1: Age wise distribution.



Age Group	Frequency	Percentage
20-30 Years	4	4
30-40 Years	10	10
40-50 Years	34	34
50-60 Years	38	38
60-70 Years	14	14
TOTAL	100	100

This observation reveals that in age wise selection of patients, maximum numbers of patients were found in 50-60 age groups i. e. 38 %.

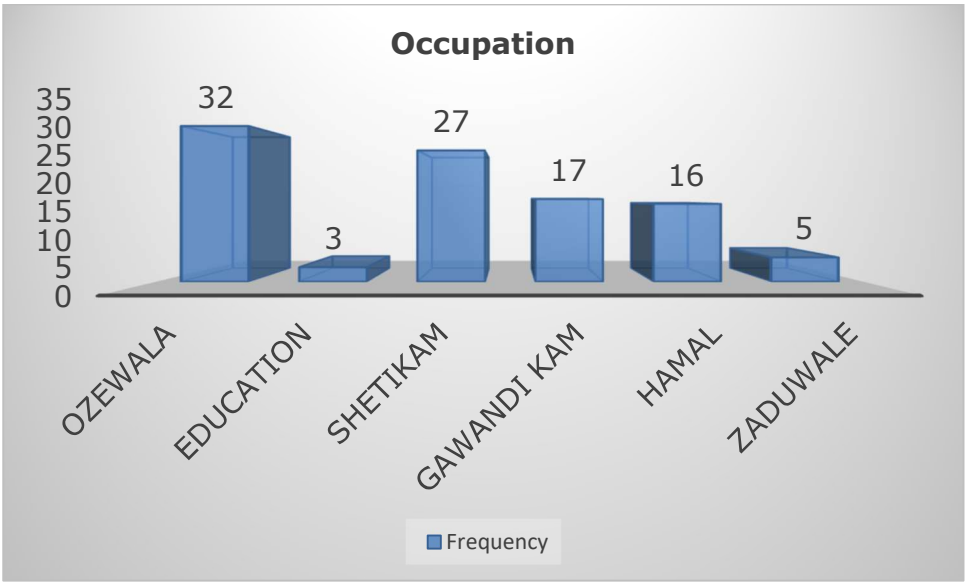
Table 2: Gender wise distribution.



Gender	Frequency	Percentage
Male	50	50
Female	50	50
TOTAL	100	100

This study constitutes a total of 100 patients, out of which 50% were male patients and 50 % were female patients.

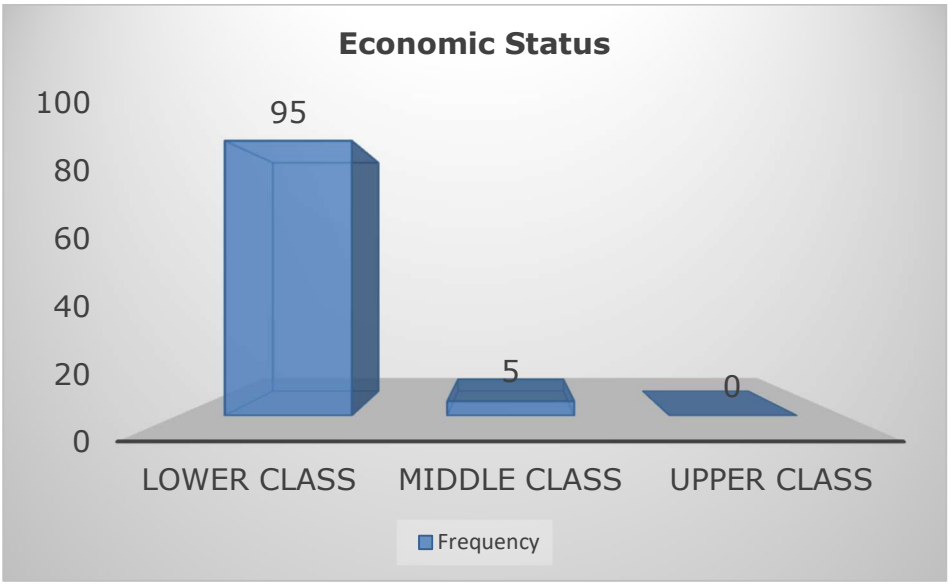
Table 3: Occupation wise distribution.



Occupation	Frequency	Percentage
Ozewala	32	32
Education	3	3
Shetikam	27	27
Gawandi Kam	17	17
Hamal	16	16
Zaduwale	5	5
TOTAL	100	100

In this Observation revealed that the most commonly patients of Chal murdhata constitute the occupation of *ozewala* (weight lifting) i. e. 32 % & Occupation of same kind which offers a lot of overhead work put extra stress on our neck i. e. *Shetikam* (farmers) 27%, 17% were belongs to *Gawandikam* and 16% were *Hamal* & 5 %were *Zaduwale* and very less i. e. 3% were educated.

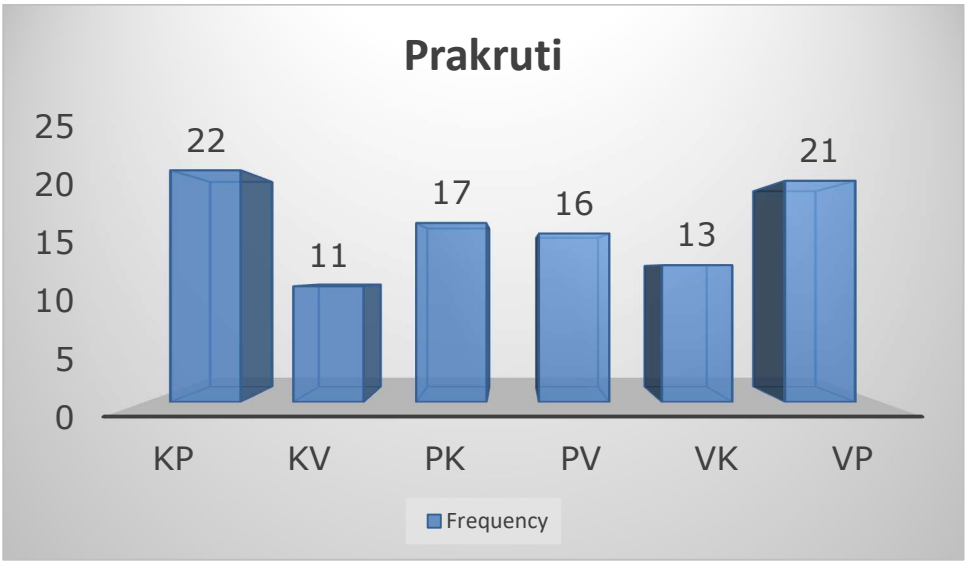
Table 4: Economic status wise distribution.



Economic Status	Frequency	Percentage
Lower Class	95	95
Middle Class	5	5
Upper Class	0	0
TOTAL	100	100

Histogram shows that in this study 95 % patients were from lower economic class, 5 % patients from middle class.

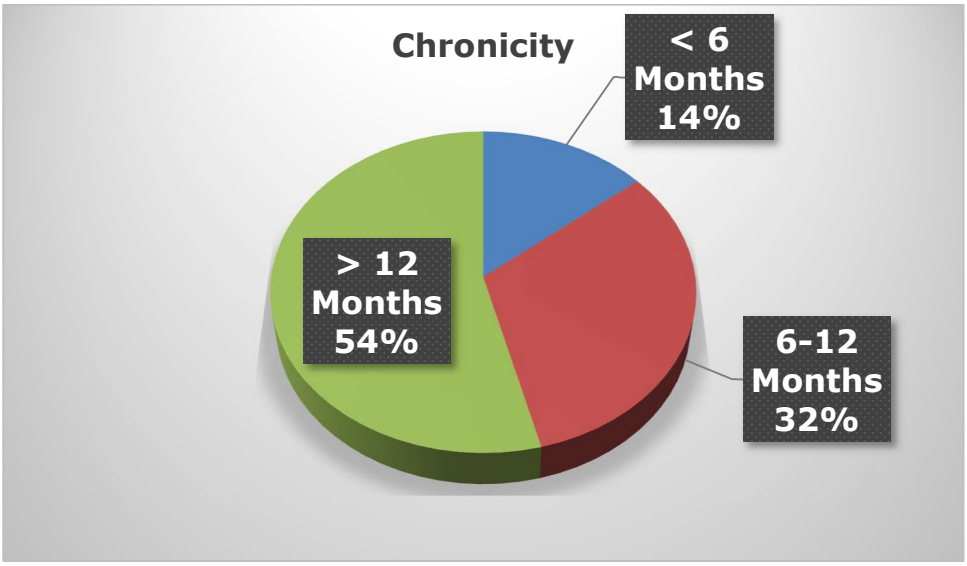
Table 5: Prakruti wuse distribution.



Prakruti	Frequency	Percentage
KP	22	22
KV	11	11
PK	17	17
PV	16	16
VK	13	13
VP	21	21
TOTAL	100	100

In this study out of 100 patients 22% patients belongs to *kaphapradhan Pittanubandhi prakruti,* 21% *Vatapradhan Pittanubandhi prakruti,* 17% *Pittapradhan Kaphanubandhi,* 16% *Pittapradhan Vatanubandhi,* 13% *Vatapradhan Kaphanubandh,* 11% *kaphapradhan Vatanubandhi.*

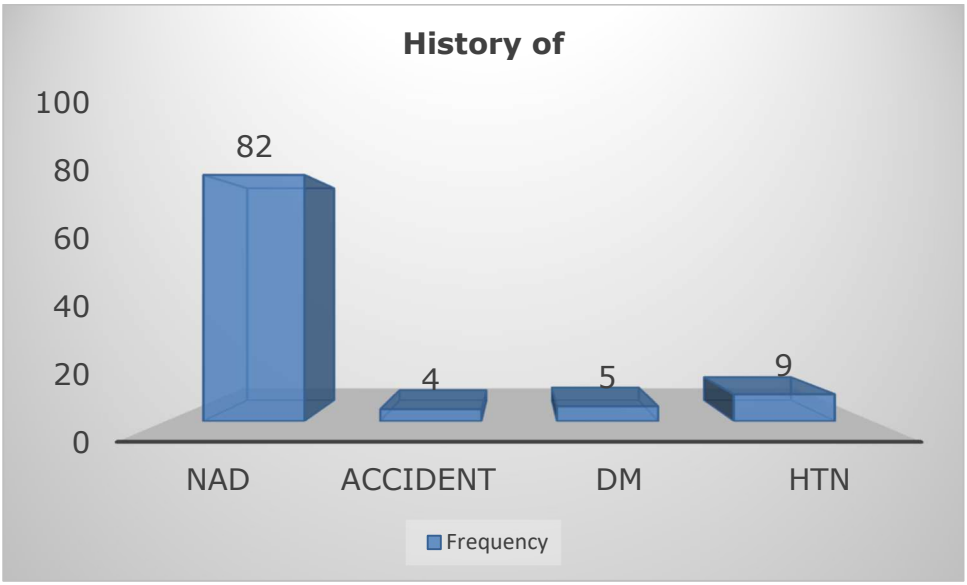
Table 6: Chronicity wise distribution.



Chronicity	Frequency	Percentage
< 6 Months	14	14
6-12 Months	32	32
> 12 Months	54	54
TOTAL	100	100

Diagram shows the chronicity of *Chalmurdhta*, i. e. 54 % Patients show the *Chalmurdhta* symptoms more than One year, 32% patient's shows *Chalmurdhta Lakshana* for 6-12 months, and 14% patient's shows *Chalmurdhta lakshana* less than 6 month.

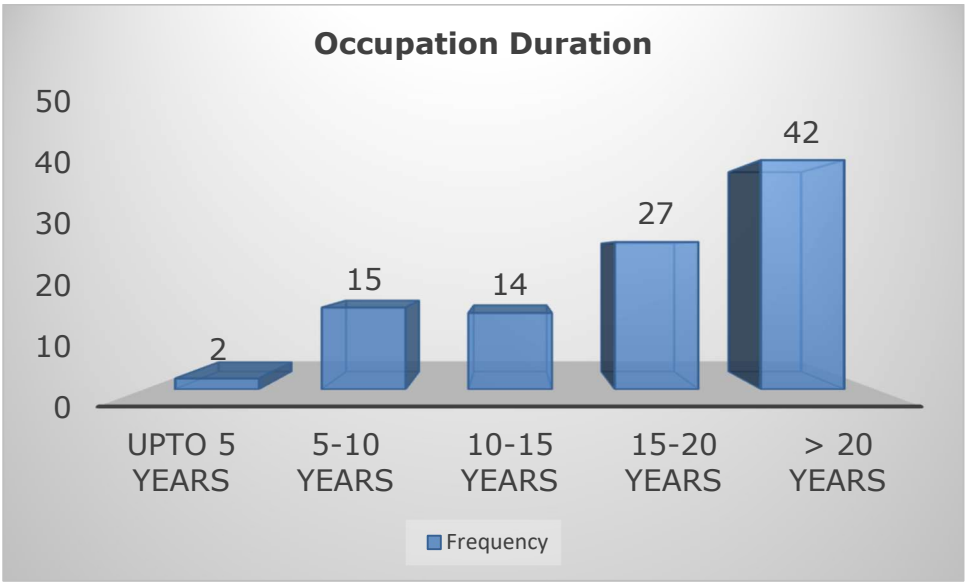
Table 7 : History of any other disease.



History of	Frequency	Percentage
NAD	82	82
Accident	4	4
DM	5	5
HTN	9	9
TOTAL	100	100

This observation reveals that out of 100 patients 82% does not haVd any history of major or minor disease. 9 % Patients had the history of Htn, 5% patients had history of Diabetes mellitus, 4% patients had history of Accident.

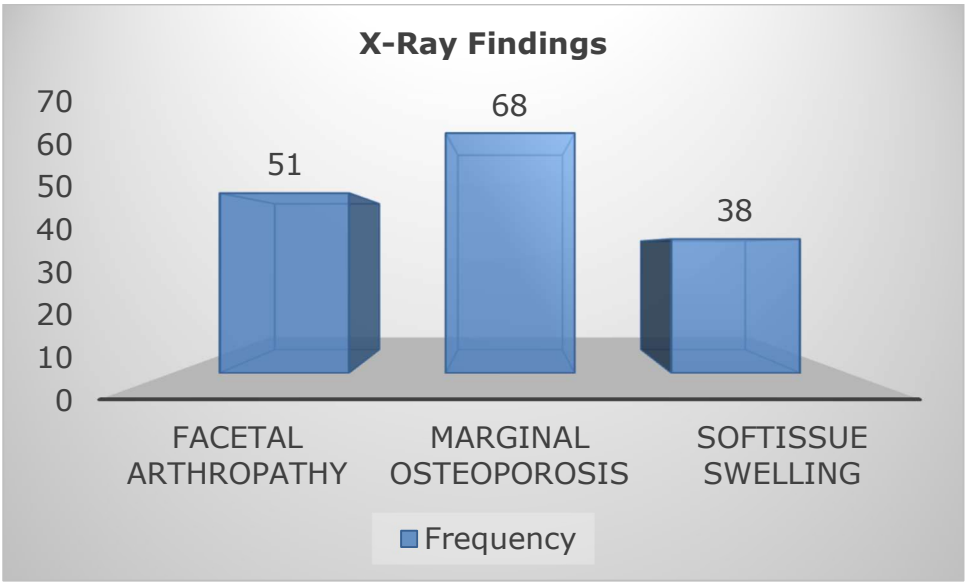
Table 8: Occupation Duration wise distribution.



Occupation Duration	Frequency	Percentage
Upto 5 Years	2	2
5-10 Years	15	15
10-15 Years	14	14
15-20 Years	27	27
> 20 Years	42	42
TOTAL	100	100

This observation revealed that the maximum patients of *Chalmurdhta* (i. e. 42%) had the occupational duration more than 20 years.

Table 9: X-Ray findings wise distribution.



X-Ray Findings	Frequency	Percentage
Facetal Arthropathy	51	51
Marginal Osteoporosis	68	68
Soft tissue Swelling	38	38

In the study we found that X-ray findings of 68 % patients shows marginal osteoporosis formation (OF) of atlas vertebra and 51% patients shows Facetal Arthropathy in atlas & axis vertebrae along with osteophytes formation and 38 % patients show the soft tissue swelling of paraspinalis muscle of atlas & axis vertebrae.

DISCUSSION

Any research work without being discussed about its nature, utility and importance, need is said to be incomplete. Discussion is nothing but the logical reasoning of observations. Thus, discussion is the important part of any research work.

As *marma* is an ancient concept, so without knowing about its exact location it is impossible to interpret its concept and
Significance to the modern era of research and science.

Marma is the site at which five anatomical structures such as *Mamsa*, *Asthi*, *Snayu*, *Dhamani*, *Sira* are involved which are essential in the formation of these vital centres. According to *Acharya Vagbhata* points where irregular pulsations and severe pain is felt when pressure is applied are known as *marma*sthanas. According to *Dalhana* the vital points are those points on the human body on which any kind of trauma or injury may lead to disability or death.

The main aim and objectives of the study highlights the determination of the location of *Krukatika marma* and its vaikalyakaratva pareekshan by analysis of *marmaghat lakshanas*. Thus, literary details of the *marma* are reviewed along with the detail study of modern literature related to *marma*. This study is an attempt to put forward the *vaikalyakaratva* property of the *Krukatika marma* by analysis of *marmaghat lakshanas* of patients with post traumatic neck injuries and establish its correlation to modern anatomical structures present at that vital point.

The study includes the detailed description of the structures observed at the neck region and structures that can be specifically concluded as *Krukatika marma.*

Location of Krukatika marma-

" कृकाटिके शिरोग्रीवासन्धौ, तत्र चलं शिरः ।"

Thus, *krukatika marma* is situated on the joint of head and neck. It is type of *vaiklyakara marma*, and also itself one of the *sandhi marma*. And '*Chalmurdhta*' is the *vailyakar lakshana* of *krukatika marma*.

At the joint place of *shira* (Head) and *Greeva* (neck) the *marma* said to be *Krukatika marma* and symptoms of *aaghata* over *Krukatika marma* is:

1. *Chalmurdhta* (involuntary movments).

According to Sushruta size of *Krukatika marma* is stated ½ *anguli pramana.* [6]

Krukatika – Articulation between the Occipital & Atlas.

Atlanto-Occipital articulation.

These are *Sandhi marmas* at the junction of Head & the neck; each is of the *vaikalyakara* type and half *anguli* in size. Injury to them cause shaking or tremors.

Classical aspect

Fourteen *marma* are present in the neck region. *krukatika* two among them. Located at the junction of *shiras* (head) and *greeva* (neck) constituted by *sandhi* (joint) and measures only 1 cm (half *angul*) dimension. Injury to this give rise to *Chalmurdhta* (loss of stability of head), therefore this is included under *vaikalyakara* (deformity) category.

Krukatika marma form the junction of head and neck and thus the most delicate area. Any injury to this *Marma* causes instability to the head. Therefore, any injury or painful conditions or swelling in this area should be addressed with top priority since *Krukatika Marma* would be involved.

Anatomical feature of *krukatika* region-

According to modern literature *Krukatika marma* is located in the region of craniocervical junction.

Structure involved –

Atlanto-occipital joint,

Atlanto-occipital membrane,

Atlanto-occipital ligament.

1. Atlanto occipital joint –

The atlanto-occipital joint (articulation between the atlas and the occipital bone) consists of a pair of a pair of a pair of condyloid joints. The atlanto-occipital joint is a synovial joint.

Attachments – Anterior atlanto-occipital membrane; dense, broad fibrousstructure which connects the anterior arch of atlas to the anterior clivus; it is continuation of the anterior longitudinal ligament and prevents excessive neck extension.

Posterior atlanto–occipital membrane: a broad but thin fibrous membrane which connects the posterior foramen magnum to the superior aspect of the posterior atlantal arch and blends with the joint capsule laterally.

2. Atlanto–occipital ligament - The ligaments connecting the Bones are

Two articular capsules.

Posterior atlanto–occipital membrane.

Anterior atlanto–occipital membrane.

3. Atlanto occipital membrane-

The posterior atlanto-ocipital membrane broad but thin membrane it is connected above to the posterior margin of the foramena magnum and bellowto the upper border of the posterior arch of the atlas. On each side of this membrane there is defect above the groove for the vertebral artery which serves as an opening for the entrance of the artery. The suboccipital nerve also passes through this defect. The free border of membrane arches over the artery and nerve and is sometime ossified.

Discussion based on observational study

In the study 100 patients were randomly selected from OPD and IPD who came with symptoms of *Chalmurdhta* and were in the inclusion criteria for the study.

1. AGE:

This observation reveals that in age wise selection of, maximum numbers of patients with *Chalmurdhta* were found in above 40 years.

In this study maximum numbers of patients, i. e. 38% were in the age group between 50-60 years and followed by age group 40-50 years (34%). 14 % patients were found in age group 60-70 years. It may long time duration of any occupation which includes long time sitting with neck holding in specific posture or any specific awkward posture. Or may be due *vata* is dominant in old age. and *Involuntary movements may* occur due to vitiated *vata.*

2. GENDER:

This study constitutes a total of 100 patients, out of which 50 % were male patients and 50 % were female patients. There is no difference in gender wise.

3. RELIGION:

In this study, most of the patients were Hindu 85 %, while Muslim patients are 10 %, Buddhist are 1 %, and Sikh patients are 4 %. This may be due to Geographical dominance of Hindus people in this region, might be a reason for high incidence.

4. OCCUPATION:

In this Observation revealed that the most commonly patients of *Chal murdhata* constitute the occupation of *ozewala* (weight lifting) i.e. 32 % & Occupation of same kind which offers a lot of overhead work put extra stress on our neck i.e. *Shetikam* (farmers) 27%, 17% were belongs to *Gawandikam* and 16% were *Hamal* & 5 %were *Zaduwale* and very less i.e. 3% were educated.

It indicates that this occupation may put some extra stress on *krukatika marma* which may cause the *chal murdhata.*

5. ECONOMIC STATUS:

In this study 95 % patients were from lower economic class, 5 % patients from middle class. Max patients i.e. *ozewala, Shetikam* (farmers), *Gawandikam*, *Zaduwale* belongs to lower class that's why the incidence of *chal murdhata.*is common in this economic class.

6. MARITAL STATUS:

In this study 97% patient were married and 3% patients were unmarried. In this study maximum patient as per inclusive Criteria belongs to Age group from 18 to 70 years. There fore maximum patients were married.

7. PRAKRUTI:

In this study out of 100 patients 22% patients belongs to *kaphapradhan Pittanubandhi prakruti,* 21% *Vatapradhan Pittanubandhi prakruti,* 17% *Pittapradhan Kaphanubandhi,* 16% *Pittapradhan Vatanubandhi,* 13% *Vatapradhan Kaphanubandh,* 11% *kaphapradhan Vatanubandhi.* There is no such difference in *Prakruti* wise distribution.

8. CHRONICITY:

In the chronicity of *Chalmurdhta*, i. e. 54 % Patients show the *Chalmurdhta* symptoms more than One year, 32% patient's shows *Chalmurdhta Lakshana* for 6-12 months, and 14% patient's shows *Chalmurdhta lakshana* less than 6 month. In this study above fifty percent patients had *Chalmurdhta lakshana* more than one year. This may be due to maximum patients in the study wre above 40 years of age.

9. HISTORY OF ANY OTHER DISEASE:

This observation reveals that out of 100 patients 82% does not haVd any history of major or minor disease. 9 % Patients had the history of Htn, 5% patients had history of Diabetes mellitus, and 4% patients had history of Accident. Thus there is no role of any other disease in causing the *lakshana* of *Chalmurdhta.*

10. DURATION OF OCCUPATION:

In this Observation revealed that the maximum patients of *chal murdhata* (i. e. 42%) had the occupational duration more than 20 years. 27% patients had duration of 15-20 years. 15% patients of *Chalmurdhta* had duration of occupation about 10-15 years. 2% patients had duration of occupation about 2 years. It indicates that more duration of work or occupation put more strss on *Krukatika marma* which may lead to *Chalmurdhta* i. e. the *Viddha lakshana* of *Krukatika Marma.*

11. CHALMURDHTA

chalmurdhta means the shaking movments of neck and head or the involuntary movements of neck.

Meaning of involuntary movements are acting or done without or against will, performed or acting without conscious control or carried out without one's conscious wishes, not voluntary.

Involuntary movements mean unintentional. Unconscious, not voluntary, independent of one's will.

Acting or happening without forethought, prompting, planning

12. X- RAY FINDINGS.

In the study we found that X-ray findings of 68 % patients shows marginal osteoporosis formation (OF) and 51% patients shows Facetal Arthropathy in cervical vertebrae along with osteophytes formation. 38 % patients show the soft tissue swelling.

According to modern literature *Krukatika marma* is located in the region of craniocervical junction.

Structure involve are

Atlanto-occipital joint,

Atlanto-occipital membrane,

Atlanto-occipital ligament.

1. Atlanto occipital joint –

The atlanto-occipital joint (articulation between the atlas and the occipital bone) consists of a pair of a pair of a pair of condyloid joints. The atlanto-occipital joint is a synovial joint.

Attachments – Anterior atlanto-occipital membrane; dense, broad fibrous structure which connects the anterior arch of atlas to the anterior clivus; it is continuation of the anterior longitudinal ligament and prevents excessive neck extension.

Posterior atlanto–occipital membrane: a broad but thin fibrous membrane which connects the posterior foramen magnum to the superior aspect of the posterior atlantal arch and blends with the joint capsule laterally.

Weight lifting for long period, forward bending related with *Zaduwale* and Formers. In which patients have to keep the neck continuous in one position. Also, labors and formers also have bend neck continuously while doing laborious work, thus pressure over cranio-cervical joints develops wear n tear resulting in to stress to *Krukatka marma*.

Also, the structure presents at location of *Krukatika marma* are responsible for the movements of neck i. e. voluntary movemts of neck in normal condtion. But when this structure posses some abnormility between them its leads to involuntary movements of neck. Thus, we can say that any stress or injury leads to *Krukatika Marma* has great contribution in causing Involuntary movements of Neck.

Occipito - Atlas joint, which is site of *krukatika marma* which causes *vaikalyakartva* that is restricted movements of Occipito - Atlas joint.

Due to excessive Involuntary movement & trauma at Occipito - Atlas joint causes deformity. That deformity may be in micro-anatomical changes or it may be in functional in Nature.

Thus, there is relation between *Krukatika Marma* and Involuntry Movements.

❖ FURTHER SCOPE OF STUDY: -

Here it is noteworthy that, not all the anatomical changes occur at cranio-cervical joint in *Chal murdhata* are display in x-ray findings. Therefore, in such conditions patients might be needed some additional investigations or radiological examinations like MRI, contrast myelogram etc. to improve the treatment.

It is true that, this dissertation work is just a step toward the final achievement and we hope that this will help the further research scholars to reach the destination.

❖ LIMITATION OF STUDY: -

- This study is con ducted on small sample size i.e., 100.Larger sample size will be more pricise the result.
- This study includes single objective parameter as investigating tool (x-ray) for observation of anatomical changes.
- If the sample size, duration of study, Objective parameters, subjective parameters and inclusive & exclusive criteria will be raised, then the result may show some variations.
- It may give better accuracy with positive result.

CONCLUSION

The entire work, entitled "**Anatomico-Clinical Study of Involuntary Movements (*Chal Murdhata Lakshana*) WSR head & its relation with *Krukatika Marma*"** concluded as below-

Anatomical and clinical study:

On the basis of all observations and analysis of x-ray findings in patients of involuntary movements it is concluded that-

Occipito - Atlas joint, which is site of *krukatika marma*. Due to excessive stress & trauma at Occipito - Atlas joint causes deformity. That deformity causes micro-anatomical changes in that region and involuntary movements of head.

From all the statistical analysis, out of all the patients, we found that X-ray findings, 68 % patients shows marginal osteoporosis formation (OF) of atlas vertebra and 51% patients shows Facetal Arthropathy in atlas & axis vertebrae along with osteophytes formation and 38 % patients show the soft tissue swelling of paraspinalis muscle of atlas & axis vertebrae in X-ray findings.

On the basis of statistical analysis of observations, it is concluded that in individuals such as *Ozekam, Shetikam, Gawandikam, Hamal, Zaduwale* related to heavy load occupations with long duration causes *Krukatika marma viddhata* leading to *Chalmurdhta i.e involuntary movements.*

Finally on the basis of all parameters such as involuntary movements and X-ray findings of cervical region anteroposterior vew as well as lateral view, it is concluded that there is significant relation in *Krukatika Marma* and involuntary movements of head (*Chal-Murdhataa Lakshana*).

BIBLIOGPHY

1. Introduction to Ayurveda, Vasant lad, The Ayurvedic Institute, Albuquerque, https://www.easyayurveda.com

2. Kaviraja Ambikadutta shastri, Sushrutasamhita of maharshi susruta, Chaukhambha Sanskrit sansthan, Reprint 2007, Su.Su.1/23, page – 4

3. Article by Dr. Raghuram Y.S. and Dr. Manasa, Marma Shareera: Defination, Compisition: Vital Points of the Body; https://www.easyayurveda.com

4. Reason to get a Marma point therapy treatment, Bliss Bliss, Sept. 17, 2012, www.the blissblissbliss.com

5. Dr. Bhaskar Govind Ghanekar, Sushrutsamhita sharirsthanam with 'Aayurvedrhasyadipika' hindi commentary, Meherchandra lakshmandasa publication, Delhi, Third edition. Su.sha.6/23, page 186.

6. Kaviraja Ambikadutta shastri, Sushrutasamhita of maharshi susruta, Chaukhambha Sanskrit sansthan, Reprint 2007, Su.sha.6/29, page 375

7. Vaidya Yadavji Trikamji Acharya, Sushrutasamhita of maharshi Susruta, with the Nibandhasangraha Commentary of Shi Dalhanacharya, Chaukhambha Orientalia, Varanasi. Su.Sha.6/3, Page-369.

8. What is Marma Therapy, https://www.artofliving.org

9. What is marma, https://www.yogapedia.com

10. Shri. Brhmashankar mishr Shastri, Shrimad Bhawmishra pranit Bhawprakash samhita with 'Vidhyotini' commentary, Chaukhamba Sanskrit bhavan, Varanasi. Pratham khand- 3/223

11. Dr. Anna Moreshwar Kunte, Ashtanghrudyam of Vagbhata with the Commentaries 'Sarvangasundara' of Arunadatta & 'Ayurvedarasayana' of Hemadri, Chaukhamba surbharati prakashan, Varanasi. Reprint edition 1997, A.Hr.sha. 4/37, page- 413.

12. Dr. Brahmanand Tripathi, Sarangadhara Samhita of Pandit Sarangadharacharya, Chaukhamba Surbharati Prakashan, Varanasi. Reprint 2004. Sha. Pu. 5/59 .

13. Priyawat Sharma, Susruta samhita with English translation of text and Dalhana's commentary along with critical notes, Chaukhambha visvabharti Oriental Publishers & Distributors, Vol.II, Su.sha.6/3, page no. 184.

14. Dr. Anna Moreshwar Kunte, Ashtanghrdayam of Vagbhata, with Srvangasundara of Arunadatta & Ayurvedarasayana of Hemadri, Chaukhamba Sanskrit sansthan Varanasi,Edition: Reprint, 2016, A.Hr.Sha.4/42, page no. 413.

15. Priyawat Sharma, Susruta samhita with English translation of text and Dalhana's commentary along with critical notes, Chaukhambha visvabharti Oriental Publishers & Distributors, Vol.II, Su.sha.6/8, page no.186.

16. Priyawat Sharma, Susruta samhita with English translation of text and Dalhana's commentary along with critical notes, Chaukhambha visvabharti Oriental Publishers & Distributors, Vol.II, Su.sha.6/16, page no. 188.

17. Priyawat Sharma, Susruta samhita with English translation of text and Dalhana's commentary along with critical notes, Chaukhambha visvabharti Oriental Publishers & Distributors, Vol.II, Su.sha.6/38, page no. 198.

18. Priyawat Sharma, Susruta samhita with English translation of text and Dalhana's commentary along with critical notes, Chaukhambha visvabharti Oriental Publishers & Distributors, Vol.II, Su.sha.6/40, page no. 198.

19. Priyawat Sharma, Susruta samhita with English translation of text and Dalhana's commentary along with critical notes, Chaukhambha visvabharti Oriental Publishers & Distributors, Vol.II, Su.sha.6/28-30, page no.196.

20. Prof. Jyoti Mishra, Astangasamgraha of Vruddha Vagbhata with Sasilekha sankrit commentary by Indu, Chowkhamba Sanskrit series offive, Varanasi, edition 2006. A.Sa.Sha. 7/47, page no. 323.

21. Dr. Bhaskar Govind Ghanekar, Susruta samhit with 'Ayurvedarahasyadipika' hindi commentary, Meharchand lachhamands Publication, Reprint: March, 2006. Su. Sha. 6/36, page no. 198.

22. Dr. Anna Moreshwar Kunte, Ashtanghrdayam of Vagbhata, with Srvangasundara of Arunadatta & Ayurvedarasayana of Hemadri, Chaukhamba Sanskrit sansthan Varanasi,Edition: Reprint, 2016, A.Hr.Sha.4/29, page no. 412.

23. Wenimadhawa shastri Joshi, Narayan hari Joshi, Ayurvediy shabdkosh/ Mahakosh, Maharashtra rajya sahitya sammelan ans sanskrutik mandal, Mumbai, Pratham khand, Page no. 1119-1120.

24. Wenimadhawa shastri Joshi, Narayan hari Joshi, Ayurvediy shabdkosh/ Mahakosh, Maharashtra rajya sahitya sammelan ans sanskrutik mandal, Mumbai, Pratham khand, Page no. 1119-1120.

25. Dr.B.K. Upadhyay, Sanskrit shabdkosh, Bhartiy vidhya sansthan, Varanasi publication, edition 2000, page no. 238

26. Pt. Haragovinda sastri, Amarkosha (Namalinganushasana of Amarsimha), with Maniprabha hindi commentary. Chowkhamba Sanskrit series office, Varanasi, Sixth edition 1998, dwitiy khand, Manushya warg, verse 95, (2/6/95),page no. 219. And 217.

27. Wenimadhawa shastri Joshi, Narayan hari Joshi, Ayurvediy shabdkosh/ Mahakosh, Maharashtra rajya sahitya sammelan ans sanskrutik mandal, Mumbai, Pratham khand, Page no. 1119-1120.

28. Acharya Raghuvir Prasad Trivedi, Parishadhya shabdarth shariram, Shree Bhaidhyanath aayurved bhawan limited, first edition 1964, page no. 173.

29. Involuntary movements 'Parkinson's disease, American Heritage Dictionary of the language, 5th edition, Houghton Mifflin Publishing company, https://www.thefreedictionary .

30. Involuntary movements, Collins English Dictionary- Complete & Unabridged, 12th edition 2014, Harper collins Publishers, https://www.thefreedictionary.

31. Involuntary movements, Random House kernerman webster's College Dictionary. https://www.thefreedictionary.

32. Involuntary movements, Collins Thesaurus of the English Language- Complete & Unabridged, 2nd edition 2002, Harper collins Publishers 1995, https://www.thefreedictionary.

33. Involuntary movements 'Parkinson's disease, American Heritage Roget's thesaurus, https://www.thefreedictionary

34. Dr.Raghuram Y.S., Dr.Manasa, Krukatika Marma: Components, Location, Effect of Injury, https://easyayurveda.com

35. Richard S. Snell, Clinical Anatomy for Medical Students; Little, Brown and Company Batson New York Toranto London, Fifth edition, Chapter 12- The back, Page 823-825.

36. Cervical vertebrae - Wikipedia, https://en.m.wikipedia.org .

37. Cervical vertebrae - Wikipedia. http://www.physio-pedia.com 21/aug/2018 3;00pm

38. Occipital bone, https://healthline.com on January 21,2015 12:15 pm.

39. Study of vaikalyakara marma w.s.r.to orthopedic traumas –

Vd. Tiwari S.P, Lucknow University.

40. A study of sandhi marma (janu marma) with reference to intensity and mode of trauma – Vd. Raipa usha Lucknow University.

41. Marma ke pariprekshya mein vaikalyakara marma ka adhyayana –Vd. Mishra kamlesh, Jaipur university.

42. Urdhva-shakhagata vaikalyakara marma: Ek Rachanatmaka Adhyayana – Vd. Borkar B.A. Nagpur University.

43. Kakshadhara marmacha Rachanatmaka abhyasa tasya vaikalyakarattva pareekshana – Vd. Nehare r.k, Nanded University.

44. Vaikalyakara marma vichara visheshtaha koorpara marma vaikalyakarattva abhyasa – Vd. Mule S.K., Nanded University.

ANNEXURE

ABBREVIATIONS:

सु. सू. – सुश्रुत सूत्रस्थान.

सु. शा.– सुश्रुत शारिरस्थान.

च. सू. – चरक सूत्रस्थान.

Su.Su.- Sushrut Sutrasthan.

Su.Sha.- Sushrut Sharirsthan.

Ch.Su.- Charak Sutrasthan.

सु. शा – *Sushrut Sharirsthana.*

सु. सू – *Sushrut Sutrasthana.*

च. सू – *Charak Sutrasthana.*

अ. ह्र. सू – *Ashtang Hridaya Sutrasthana.*

अ. ह्र. शा. – *Ashtang Hridaya Sharirsthana.*

अ. सं. शा – *Ashtang Sangraha Sharirsthana.*

शा.स.पू.खं – *Sharangadhar Samhita Purva khanda.*

P – Probability

w.s.r. – With Special reference to

i.e. – That is

OF - Osteophyte Formation.

SR - Space reduction.

CASE RECORD FORM

"Anatomico-Clinical Study of Involuntary Movements (*Chal-Murdhataa Lakshana*) WSR head & its relation with *Krukatika Marma*"

Case No.: Date:

Reg. No.: Marital status:

Name of the Patient: Sex:

Age: Occupation:

Religion: Habitat:

Educational Status: Residential Address:

- **Present Complaints & Duration:**

Sign	**Horizontal/lateral**	**Flexion/Extension**	**Restriction/Spastic**
1. Direction of movements of neck			
2 Pain during movement of neck			
3 Allied system			
4 Configuration of episode			

- Past H/O any other disease:

- **Hetu:**

- **GENERAL EXAMINATION:**

Temp -

B.P -

Pulse -

- **SYSTEMIC EXAMINATION:**

1. Pranavaha strotas –
2. Udakvala strotas –
3. Annavaha strotas –
4. Rasavaha strotas –
5. Raktavaha strotas –
6. Mamsavaha strotas –
7. Medovaha strotas –
8. Asthivaha strotas –
9. Majjavaha strotas –

❖ Neurological test

a) Unable to walk

b) Finger nose test

c) Guait test

d) Torticoilis

- **ASHTAVIDHA PARIKSHANA –**

Nadi	-	Mutra	-
Mala	-	Jivha	-
Shabda	-	Sparsha	-
Druk	-	Aakruti	-

- **LOCAL EXAMINATION OF NECK REGION (GREEVA):**

1) Swelling:

2) Pain:

3) Tenderness and Stiffness:

- **INVESTIGATIONS:**

Impression of X-Ray of Cervical region. –

- **DIAGNOSIS:**

CONSENT FORM

I, the undersigned, Mr./Mrs./Ms._____, aged_____, sex-__ resident of_____ in complete healthy state of my mind, give permission to perform necessary examination & laboratory investigations on myself. I have been explained in my own language about the purpose, risks & expected benefits of this research study entitled-

"**Anatomico-Clinical Study of Involuntary Movements (*Chal Murdhata Lakshana*) WSR head & its relation with *Krukatika Marma*"**

I reserve my right to withdraw anytime from this study.

Date: Signature:

Patient's name:

अनुमती पत्र

मी, खाली सही केलेला, श्री./श्रीमती./कु._____ वय-----_____, पत्ता-_____ माझ्या स्वेच्छेने या परिक्षणासाठी संमती देत आहे. परीक्षण करणाऱ्या वैद्याने मला समजेल अशा भाषेत परीक्षणाचे उद्देश्य व लाभ याविषयी पूर्ण माहिती दिली आहे. त्यासाठी लागणाऱ्या सर्व प्रकारच्या तपासण्या करुन घेण्यास मी तयार आहे. माझ्यावर होणारे परीक्षण थांबवण्याचा हक्क मी अबाधित ठेवत आहे.

दिनांक: सही:

रुग्णाचे नाव:

KEY TO MASTER CHART

- Sr. No. - Serial number
- Gender
  - M - Male
  - F - Female
- Religion
  - H - Hindu
  - M - Muslim
  - B - Buddhist
  - S - Sikh
- Educational status
  - E - Educated
  - NE - Non educated
- X-ray findings
  - OF - Ostoporosis Formation

Master chart

Sr.no	Age	sex	Religion	Occupation	Economic stutas	Marital	Prakruti	cronisity of disease	family h/o	occupation duration
1	46	M	Hindu	H	LC	M	VP	1 YRS	NAD	16 yrs
2	40	M	Hindu	H	LC	M	VK	11 MONTH	NAD	15 yrs
3	56	M	Shikh	CA	LC	M	KP	14 MONTH	NAD	26yrs
4	64	M	Hindu	CA	LC	M	KP	9 MONTH	NAD	20 yrs
5	30	M	Hindu	A	MC	M	VP	8 MONTH	NAD	15yrs
6	40	M	Hindu	A	LC	M	VP	11 MONTH	NAD	20 yrs
7	46	F	Hindu	FF	MC	M	VK	6 MONTH	NAD	20 yrs
8	55	F	Hindu	FF	LC	M	PK	15 MONTH	NAD	30yrs
9	40	F	Hindu	GF	LC	M	VP	11 MONTH	NAD	20 yrs
10	42	F	Hindu	GF	LC	M	VK	10 MONTH	NAD	22 yrs
11	48	F	Hindu	SF	LC	M	VP	7 MONTH	NAD	30 yrs
12	60	F	Hindu	SF	LC	M	KP	16 MONTH	NAD	25 yrs
13	50	M	Muslim	H	LC	M	KP	18 MONTH	NAD	25 Yrs
14	48	M	Hindu	H	LC	M	PK	6 MONTH	NAD	23 Yrs
15	62	M	Hindu	CA	LC	M	KP	6MONTH	NAD	32 Yrs
16	59	M	Hindu	CA	LC	M	VK	8 MONTH	NAD	30 Yrs
17	20	M	Hindu	A	MC	UM	VK	12 MONTH	NAD	15 Yrs
18	22	M	Hindu	A	MC	M	VP	11 MONTH	NAD	20 Yrs
19	43	F	Hindu	FF	LC	M	VP	10 MONTH	NAD	23 Yrs
20	66	F	Hindu	FF	LC	M	VP	11 MONTH	NAD	35 Yrs
21	53	F	Hindu	GF	LC	M	KP	9 MONTH	NAD	25 Yrs
22	58	F	Hindu	GF	LC	M	PK	10 MONTH	NAD	23 Yrs
23	60	F	Muslim	SF	LC	M	KP	1 YEAR	NAD	20 yrs
24	45	F	Hindu	SF	LC	M	PK	9 MONTH	NAD	15 yrs
25	50	M	Hindu	H	LC	M	PK	11 month	NAD	20 yrs
26	53	M	Hindu	H	LC	M	PV	18 MONTH	NAD	23 Yrs
27	57	M	Hindu	CA	LC	M	KV	8 MONTH	DM	27 Yrs
28	48	M	Hindu	CA	LC	M	PK	13 MONTH	NAD	17 Yrs
29	43	F	Muslim	FF	LC	M	KV	14 MONTH	NAD	22 yrs
30	54	F	Muslim	FF	LC	M	PK	6 MONTH	HTN	34 Yrs
31	66	F	Hindu	FF	LC	M	KP	8 MONTH	NAD	36 Yrs
32	54	F	Hindu	GF	MC	M	KV	1 YEAR	NAD	24 Yrs
33	60	F	Hindu	GF	LC	M	KP	15 MONTH	NAD	40 Yrs
34	49	F	Hindu	GF	LC	M	VK	16 MONTH	DM	18 Yrs
35	51	F	Hindu	SF	LC	M	VP	13 MONTH	NAD	19 Yrs
36	49	M	Hindu	H	LC	M	VP	1 YEAR	NAD	29 Yrs
37	56	M	Hindu	H	LC	M	KP	2 YEAR	NAD	32 Yrs
38	63	M	Hindu	CA	LC	M	PV	4 MONTH	HTN	37 Yrs
39	39	M	Hindu	CA	LC	M	VK	5 MONTH	NAD	9 Yrs
40	44	M	Shikh	CA	LC	M	KP	8 MONTH	NAD	24 Yrs
41	46	M	Hindu	CA	LC	M	PV	10 MONTH	NAD	20 yrs
42	58	F	Hindu	FF	LC	M	PK	13 MONTH	NAD	28 Yrs
43	43	F	Hindu	FF	LC	M	PK	16 MONTH	NAD	20 yrs
44	45	F	Hindu	GF	LC	M	KP	15 MONTH	HTN	18 Yrs
45	62	F	Hindu	GF	LC	M	PK	8 MONTH	NAD	30 yrs
46	38	M	Hindu	H	LC	M	VP	5 MONTH	NAD	10 Yrs
47	40	M	Muslim	H	LC	M	PV	9 MONTH	DM	15 yrs
48	43	M	Hindu	CA	LC	M	VP	6 MONTH	NAD	13 Yrs
49	61	M	Hindu	CA	LC	M	KP	10 MONTH	NAD	25 yrs
50	53	M	Hindu	CA	LC	M	VP	11 MONTH	NAD	20 yrs
51	57	M	Hindu	CA	LC	M	PK	13 MONTH	NAD	27 Yrs
52	58	F	Muslim	FF	LC	M	VP	14 MONTH	HTN	30 yrs
53	55	F	Hindu	FF	LC	M	PV	6 MONTH	NAD	15 yrs
54	48	F	Hindu	FF	LC	M	PV	9 MONTH	NAD	18 Yrs
55	57	F	Hindu	FF	LC	M	KP	10 MONTH	NAD	28 Yrs
56	46	F	Hindu	GF	LC	M	PV	7 MONTH	NAD	18 Yrs
57	50	F	Hindu	GF	LC	M	KV	18 MONTH	NAD	20 yrs

58	52	M	Hindu	H	LC	M	PV	4 MONTH	HTN	12 Yrs
59	50	M	Hindu	H	LC	M	VP	10 MONTH	NAD	20 yrs
60	62	M	Hindu	CA	LC	M	VK	11 MONTH	NAD	35 Yrs
61	60	M	Muslim	CA	LC	M	KV	13 MONTH	NAD	31 Yrs
62	40	M	Hindu	CA	LC	M	PK	8 MONTH	DM	10 Yrs
63	38	M	Hindu	CA	LC	M	VK	9 MONTH	NAD	5 Yrs
64	50	F	Hindu	FF	LC	M	KP	3 MONTH	NAD	20 yrs
65	55	F	Hindu	FF	LC	M	PK	7 MONTH	NAD	25 yrs
66	50	F	Hindu	FF	LC	M	KV	8 MONTH	NAD	10 Yrs
67	43	F	Hindu	FF	LC	M	VP	10 MONTH	NAD	10 Yrs
68	38	F	Hindu	GF	LC	M	VK	9 MONTH	NAD	11 Yrs
69	62	F	Hindu	GF	LC	M	PK	13 MONTH	HTN	15 yrs
70	51	F	Hindu	GF	LC	M	PV	10 MONTH	NAD	20 yrs
71	55	M	Hindu	H	LC	M	KV	18 MONTH	NAD	25 yrs
72	50	M	Muslim	H	LC	M	PV	16 MONTH	NAD	20 yrs
73	53	M	Hindu	CA	LC	M	VP	12 MONTH	DM	23 Yrs
74	59	M	Hindu	CA	LC	M	PK	11 MONTH	NAD	29 Yrs
75	60	M	Hindu	CA	LC	M	PV	10 MONTH	NAD	38 Yrs
76	46	M	Shikh	CA	LC	M	VK	9 MONTH	NAD	16 yrs
77	70	F	Hindu	FF	LC	M	VP	13 MONTH	NAD	40 Yrs
78	68	F	Hindu	FF	LC	M	KP	11 MONTH	HTN	38 Yrs
79	64	F	Shikh	FF	LC	M	PV	18 MONTH	NAD	32 Yrs
80	47	F	Hindu	FF	LC	M	KP	8 MONTH	NAD	15 yrs
81	56	F	Hindu	GF	LC	M	PV	10 MONTH	NAD	18 Yrs
82	42	F	Hindu	GF	LC	M	KV	13 MONTH	NAD	15 yrs
83	40	F	Hindu	GF	LC	M	PK	7 MONTH	NAD	13 Yrs
84	58	F	Hindu	H	LC	M	KP	10 MONTH	NAD	19 Yrs
85	55	F	Hindu	H	LC	M	PV	5 MONTH	HTN	35 Yrs
86	50	M	Hindu	CA	LC	M	VP	4 MONTH	NAD	15 yrs
87	66	M	Hindu	CA	LC	M	VK	10 MONTH	NAD	20 yrs
88	62	M	Hindu	CA	LC	M	KP	14 MONTH	NAD	22 yrs
89	57	M	Hindu	CA	LC	M	PV	10 MONTH	NAD	20 yrs
90	50	F	Hindu	FF	LC	M	KV	16 MONTH	HTN	9 Yrs
91	45	F	Hindu	FF	LC	M	PK	15 MONTH	NAD	8 Yrs
92	40	F	Hindu	FF	LC	M	KP	8 MONTH	NAD	5 Yrs
93	50	F	Hindu	FF	LC	M	VP	10 MONTH	NAD	10 Yrs
94	60	M	Hindu	CA	LC	M	VK	11 MONTH	NAD	17 Yrs
95	55	M	Muslim	CA	LC	M	VP	12 MONTH	NAD	15 yrs
96	58	M	Hindu	CA	LC	M	KP	16 MONTH	NAD	12 Yrs
97	53	M	Hindu	CA	LC	M	VP	9 MONTH	NAD	10 Yrs
98	48	M	Hindu	CA	LC	M	VK	11 MONTH	NAD	8 Yrs
99	59	M	Hindu	CA	LC	M	KV	14 MONTH	NAD	20 yrs
100	56	F	Hindu	FF	LC	M	PV	18 MONTH	NAD	10 yrs

Disease	Associated with	involvement	Movement of neck muscle	Causative factor	Investigation results	etiology	Signs and symptoms	Diagnostic parameter	Clinical reflex
SPASMODIC TORTICOLLIS	CERVICAL DYSTONIA Classification 1] primary spasmodic torticollis 2] secondary spasmodic torticollis	Neurological Condition chronic	Left, right, upward /downward	idiopathic	No neurodegenerative changes No lesion basal ganglia	Functional imbalance due to imbalance of neurotransmitter such as dopamine, acetylcholine, gamma amino butyric acid	Mild -Invisible tremor for few months at onset Head may turn, pull or tilt in jerky movements or sustain a prolonged position involuntarily -overtime increase strength and frequency in involuntary spasm of neck muscle until plateau	TWSTRS-Toronto western spasmodic torticollis rating scale A. Severity scale. B. Disability scale. C. Pain scale.	Blink reflex, Trigemino cervical reflex
PARKINSONS DISEASE		Degenerative neurological Chronic	In early stages of parkinson's disease, rigidity is often asymmetrical and it tends to affect neck and shoulder muscles prior to the muscles of the face and extremities.	Idiopathic but involve both genetic and envoirnmental factors	MRI has become more accurate in diagnosis of the disease which can demonstrate absence of the characteristic 'swallow tail' imaging pattern in the dorsolateral substantia nigra	The motor symptoms of the disease results from the death of cells in the substania nigra, a region of the midbrain. This results in not enough dopamine in these areas. The main pathological characteristics of PD are cell death in the brain's basal ganglia. basal ganglia normally exert a constant inhibitory influence on a wide range of motor systems, preventing them from becoming active at in appropriate times.	Motor symptoms tremor, slowness of movement(bradykinesia), rigidity(cogwheel rigidity or lead-pipe rigidity), and postural instability such as festination gait, Freezing of gait, a slurred monotonous quiet voice, mask like face, and handwriting that gets smaller and smaller are other common signs. Neuropsychiatric symptoms- The most common cognitive deficit in PD is executive dysfunction, which can include problems with planning, cognitive flexibility, abstract thinking, rule acquisition, inhibiting inappropriate actions, initiating inappropriate actions, working memory and control of attention. Visuospatial difficulties are	Dopamine related activity in the basal ganglia can be directly measured with PET and SPECT scans. CT and MRI	Glabellar tap Naso palpebral reflex

							also part of the disease. Dementia is also associated with a reduced quality of life in people with PD.		
SPIN CEREBRAL ATAXIA(SCA)	spinocerebellar atrophy or spinocerebellar degeneration CERVICAL DYSTONIA	Neurological progressive, degenerative ,genetic disease	slowly progressive cerebellar ataxia and cervical dystonia	The hereditary ataxias can be inherited in autosomal dominant, autosomal recessive or X-linked manner		There are five typial autosomal-recessive disorders in which ataxia is a prominent feature; Friedreich ataxia, ataxia telangiectasia, ataxia with vit E deficiency, ataxia with oculomotor apraxia (AOA), spastic ataxia. Several types of SCA are characterized by repeat expansion of the trinucleotide sequence CAG in DNA that encodes a polyglutamine repeat tract in protein. The expansion of CAG repeats over successive generation appears to be due to slipped strand mispairing during DNA replication or DNA repair.	Spinocerebellar ataxia(SCA) is one of a group of genetic disorders characterized by slowly progressive in co-ordination of gait and is often associated with poor co-ordination of hands, speech and eye movements. SCA frequently results in atrophy of the cerebellum, loss of fine co-ordination of muscle movements leading to unsteady and clumpsy motion and other symptoms.	MRI scanning of brain and spine and spinal tap.	Brisk deep tendon reflexes
Huntington's disease	CERVICAL DYSTONIA	Genetic disorder	Uncontrollable movements of the face. Jerking of parts of the face and the head.	HD is caused by a faulty gene(mhTT) on chromosome number 4.		The faulty gene is larger than it should be. This leads to excessive production of cytosine, adenine, and guanine (CAG), the building blocks of DNA.	Personality changes, mood swings, and depression. Problems with memory and judgement. Unsteady walk and uncontrollable movements. Difficulty in speaking and swallowing, and weight loss. Slight signs of mood and emotional change.Lack of focus, slight concentration problems and	CT or MRI scan	Tendon reflexes Plantar reflex

							difficulty in functioning, for example at work. Lapses in short term memory Depression, Irritability. Difficulty speaking, including looking for words and slurring. Uncontrollable body movements.		

ESSENTIAL TREMOR	CERVICAL DYSTONIA	a progressive neurological disorder as benign tremor, familial tremor, or idiopathic tremor	Up and down or side to side	due to genetic mutation and the pattern of inheritance is most consistent with autosomal dominant transmission	Purkinje cells are especially susceptible to ethanol excitotoxicity. Impairment of Purkinje synapses is a component of cerebellar degradation that could underlie essential tremor. Some cases have Lewy bodies in the locus ceruleus.	Harmane or harmaline has been implicated in essential tremors, Harmaline's high lipid solubility enables accumulation in the brain tissue upon consumption from these environmental sources	ET can manifest as the inability to stop the tongue or hands from shaking and difficulty doing small precise tasks such as threading a needle. Even simple tasks like cutting in a straight line or using a ruler can range from difficult to impossible, depending on the severity of the condition. In disabling cases, ET can interfere with a person's activities of daily living, including feeding, dressing, and taking care of personal hygiene.	the diagnosis is established on clinical grounds	Stretch reflex oscillation Blink reflex

SYDENHAMS CHOREA	CERVICAL DYSTONIA	Neurological	Being unable to remain in a steady position	follows a streptococcal infection. It can also be complication of rheumatic fever	-	-	It can impede voluntary movements, making it difficult to perform basic tasks such as getting dressed or feeding yourself. harlequin tongue, Frequently dropping or spilling items, Abnormal gait, Muscle weakness, Slurred speech, Diminished muscle tone	Blood tests for parathyroid hormones or thyroid hormones can indicate metabolic endocrine-related chorea.	Deep tendon reflex
TARDIVE DYSTONIA	CERVICAL DYSTONIA	Neurological disorder	Twisting, tremulous worsen with movements			Tardive dystonia is most commonly the result of side effects from a type of drug which is prescribed to treat schizophrenia and psychosis called a 'dopamine receptor blocker'(DRB)	One or more involuntary movements of the face and/or mouth (oromandibular dystonia), involuntary eye closure (blepharospasm), voice problems, involuntary twisting or movement of the neck (cervical dystonia) and contortion of the trunk and limbs.	Abnormal Involuntary Movement Scale	Primitive reflex
TOURETTE SYNDROME	CERVICAL DYSTONIA	idiopathic	Neck stretching, head bobbing	Likely to caused by a combination of inherited and environmental factors. Dopamine and serotonin might play a role.		caused by a combination of inherited (genetic) and environmental factors. Chemicals in the brain that transmit nerve impulses (neurotransmitters), including dopamine and serotonin, might play a role.	sudden, brief, intermittent movements or sounds- are the hallmark sign of Tourette syndrome. They can range from mild to severe. Severe symptoms might significantly interfere with communication, daily functioning and quality of life.	There's no specific test that can diagnose Tourette syndrome. This diagnosis is based on the history of your signs and symptoms	Blink reflex

ANATOMICO-CLINICAL STUDY OF INVOLUNTARY MOVEMENTS (CHAL-MURDHATA LAKSHANA) W.S.R. HEAD AND ITS RELATION WITH KRUKATIKA MARMA

A Thesis

SUBMITTED TO THE

TILAK MAHARASHTRA VIDYAPEETH, PUNE

FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

In

AYURVEDA-SHARIR RACHANA

Under the Board of Ayurveda Studies

Estd. 1921

BY

ROKADE SURYAKANT DATTATRAYA

PRN05614007207/PhD Ayurveda/2014-15

UNDER THE GUIDANCE OF

Dr. CHANDRASHEKHAR DATTATRAYA VAIKOS

DEPARTMENT OF AYURVEDA

2022

80_Recommendation

CONCLUSION

The entire work, entitled "**Anatomico-Clinical Study of Involuntary Movements (*Chal Murdhata Lakshana*) WSR head & its relation with *Krukatika Marma*"** concluded as below-

Anatomical and clinical study:

On the basis of all observations and analysis of x-ray findings in patients of involuntary movements it is concluded that-

Occipito - Atlas joint, which is site of krukatika marma. Due to excessive stress & trauma at Occipito - Atlas joint causes deformity. That deformity causes micro-anatomical changes in that region and iinvoluntary movements of head.

In the study we found that X-ray findings of 68 % patients shows marginal osteoporosis formation (OF) of atlas vertebra and 51% patients shows Facetal Arthropathy in atlas & axis vertebrae along with osteophytes formation and 38 % patients show the soft tissue swelling of paraspinalis muscle of atlas & axis vertebrae.

On the basis of statistical analysis of observations, it is concluded that in individuals such as *Ozekam, Shetikam, Gawandikam, Hamal, Zaduwale* related to heavy load occupations with long duration causes *Krukatika marma viddhata* leading to *chalmurdhata.*

Finally on the basis of all parameters it is concluded that there is significant relation in *Krukatika Marma* and involuntary movements of head (*Chal-Murdhataa Lakshana*).