Bharath
INSTITUTE OF HIGHER EDUCATION AND RESEARCH
(Declared as Deemed-to-be University under section 3 of UGC Act, 1956)
(Vide Notification No. F.9-5/2000 - U.3, Ministry of Human Resource Development, Govt. of India, dated 4th July 2002)
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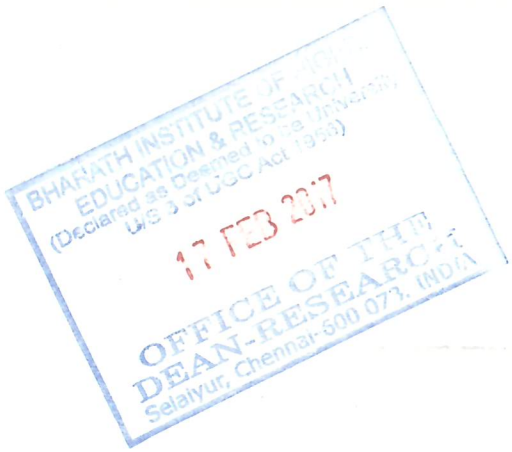
Ref. No.SMS-2015-O-08 Date: 17.02.2017



TO

Mr. Rajesh
Professor/Anatomy
BIHER

Thro: Concern Head of the Department

Greetings!!!

We are happy to announce that the Research Advisory Committee has approved your proposal for Seed Money Scheme-2015 which was presented by you. You are requested to complete the proposal and send the progress report to the Dean Research in the prescribed time period.

Title of the Project: Variations among Foramen Transversarium in Cervical Vertebrae and its Clinical Significance

Seed Money Amount: Rs.1, 00,000/- (Rupees One Lakh Only)

Approved on: 15.02.2017

Payment details:

Voucher No.29 **Dated: 24.03.2017**

With Regards

Dean-Research

Bharath University

SELAIYUR, CHENNAI - 600 073, TAMIL NADU, INDIA.

CASH / PAYMENT VOUCHER

Date 24/03/2017

V.No. 29

Debit _____ Amount

Rs. 1,00,000/-

PAID TO Dr. B. Rajesh

RUPEES One Lakh only

TOWARDS Seed Money Scheme - 2015

BHARATH UNIV. CHENNAI 600 073 INDIA

Authorised by **Finance Manager** **Cashier/Accountant** **Payee's Signature**

PROPOSAL SUBMISSION

1. **Details of Principal Investigator**

Name	: Dr. B Rajesh
Designation	: Professor
Highest Qualifications	: Ph.D.
Department	: Anatomy
E-mail	: anat_rajesh@rediffmail.com
Contact no	: 9345575143
Date of Joining	: 14.06.2010

2. **Details of Co-Principal Investigator**

Name	: N. Anandaramajayan
Designation	: Assistant Professor
Highest Qualifications	: M.Sc.,
Department	: Anatomy
E-mail	: anandaraman2006@gmail.com
Contact no	: 9894343517
Date of Joining	: 1-12-2010

Technical details

1. Introduction:

Foramen transversarium is the foramen present in the lateral masses of allcervicalvertebrae. It is present on both sides. It is one of the typical characteristic features of cervicalvertebrae. Foramen Wansversarium of typical cervical vertebra transmits 2"d part of vertebral artery, plexus of sympathetic nerves and vertebral veins [1]. Any variation in the dimensions of foramen transversarium can cause many clinical symptoms. Second part of vertebral artery passes through foramina transversaria is the most mobile part of artery during neck movements. Vertebral artery supply areas of brain stem responsible for vital functions, Cerebellum responsible for coordination, Occipital lobes responsible for sense of vision and upper 6 segments of spinal cord [21 This implies its importance [2]. Sympathetic nerve plexus derived from cervico-thoracic sympathetic chain are passing along the foramen transversarium. In case of injury to these nerve plexus leads to Hornefs syndrome with symptoms like ptosis, myosis, anhydrosis, enophthalmos etc. [2]. The vertebralveins formed from the internalvenous plexus and veins of suboccipital triangle, passes along the foramen transversarium, emerges out of sixth cervical vertebra, descends anterior to the subclavian artery and terminates into the brachiocephalic vein [I] Embryological Considerations notch and fully separated accessory foramen.

The foramen transversarium is formed by the fusion costal element to the body and the true transverse process of the vertebra. The vertebral vessels and nervous plexus are caught between these two bony parts. CostoWansverse bar — a thin plate of bone connecting the rib element to the original transverse process; closes the foramen transversarium in the lateralaspect [3, 4]. Variations of foramen Wansversarium in cervical vertebrae are common and various reports says that hypoplastic, duplicated, triplicated and accessory foramina transversaria are the variant varieties [5, 6, and 7]. Such anatomical variations may lead to a different path or extra osseous path for the contained structures [5]. Accessory foramina Wansversaria can be due to a duplicated vertebral artery or it may be formed from a fenesWation at that level in the vertebral artery [6]. Variations of the foramina transversaria can affect the course of vertebral vessels and nerves, which can attribute into various clinical pathological symptoms. A good knowledge of the anatomy and variations of these foramina will benefit clinical diagnosis and treatment of such symptoms. So we have taken this study to estimate the type and incidence of structural as well as numerical variations in foramen transversarium among typical and atypical cervical vertebrae.

2. Review of status of Research and Development in the subject

Metin Tellioglu Al, Durum Y, Gok M, Polat AG, Kamman CZ, Karakas S. Evaluation of Morphologic and Morphometric Characteristic of Foramen Transversarium on 3-Dimensional Multidetector Computed Tomography Angiography (MDCTA). Turk Neurosurg. 2017 Sep 26. doi: 10.5137/1019- 5149.JTN.18839-17.3.

The posterior arch of the atlas contains a groove for the third part of vertebral artery variable in size and depth [10]. In some cases this groove can be bridged by ossified part of bone called posterior ponticulus (Latin for bridge). Atlas bridges, also called ponticles, are bony outgrowths occurring on the atlas vertebra over the third segment of the vertebral artery, converting its groove into a sulcus, incomplete or complete foramen [11]. The canal thus formed over the posterior arch of the atlas is called as "arcuate foramen" and by an eponym "Kimmer le's anomaly" since Kimmerle was an early describer of this structure [12]. Other names are: "foramen sagittale", "foramen atlantoideum", "foramen retroarticulare superior", "canalis vertebralis", "retrocondylar vertebral artery" [13].

2.1. International Status:

Imperatively, a better understanding of the anatomical variations in FT concerning age and sex is required to properly diagnose and accurately interpret any musculoskeletal disorders, especially about the FT and its contents. Sexual dimorphism is essential in forensic medicine to analyze the accuracy of a bone in determining sex. Malik et al. [13] found significant differences between morphometric parameters in male and female, with smaller dimensions for the foramen transversarium (FT) in female specimens in computerized tomography of the cervical North American volunteers. In a magnetic resonance imaging (MRI) study, the unusual course of vertebral artery with an intra-foraminal entrance at C4 was presented. This unusual occurrence underscores the importance of preoperative diagnosis of the vertebral artery's course to avoid likely complications [14]. The knowledge of morphometric parameters and variation of FT in sex, age, and the side will help in identifying FT anomalies such as vertebral artery dissection, as well as in angiography and surgical procedures such as screw fixation in the cervical region and for radiological investigations.

2.2. National Status:

NIL

3. Progress/ achievement so far, if any

a) Reference papers was collected.
b) Literature survey was studied.
c). Materials and methods were designed

4. Work plan

4.1 Methodology

The study included human cervical vertebrae which were procured from the dry bone collections of Department of Anatomy, Andaman & Nicobar Islands Institute of Medical Sciences and Sri Lakshmi Narayana Institute of Medical Sciences, Pondicherry. The age and sex were not known. The foramina transversaria were examined from both sides of all the vertebrae. Difference in shape and number of all foramina transversaria were noted. Right and left foramina of same vertebrae compared for size difference. All the foramina transversaria of 534 cervical

vertebrae were examined carefully. Among them, 351 were typical cervical vertebra (C3, C4, CS and C6) and 183 were atypical (74 atlases, 59 axes and 50 C7- vertebra prominence). The age and sex of the bones were not known. Many foramina transversaria were showed shape variations, partially formed accessory. Foramen Wansversarium and one posterior arch canal were identified. Firstly in shape, about 60% of the foramina transversaria showed circular type (Figure lA) and 15% of the foramina transversaria showed elliptical type (Figure lB).

FT Notch:

Notch like extensions are seen in many foramina transversaria, hence we named such extensions as FT notch. This can be also referred to as partial accessory foramen.

About7% of thetotalforaminatrarisversariashowed unilateral right sided FT notch (Figure lC 1-3).

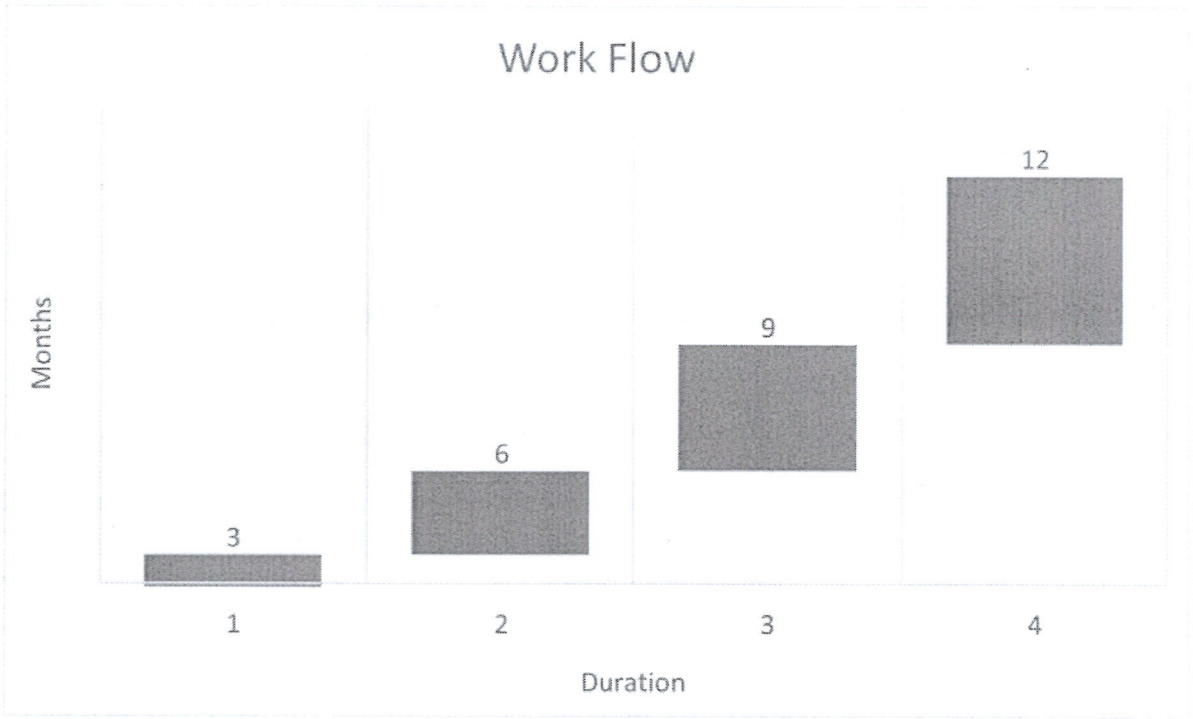
AccessonJ Foramen

Accessory foramen means additional to the already existing foramen. The smaller foramen is considered as accessory to the larger foramen. About 21% of the cervical vertebrae showed accessory foramen in FT. They can be subdivided into unilateral and bilateral. Among the unilateral type many variations are identified such as unilateral right, unilateral left, posteriorly placed accessory, anteriorly placed accessory, equally divided FT etc. Only one vertebra had bilateralaccessory foramina and they are placed posteriorly.About 16 specimen showed Unilateral Left accessory foramen Figure 2A & Figure 2B. Unilateral right Accessory and unilateral left FT notch were present in three vertebrae (Figure 2C). Variations in position of accessory foramen: About 4 cervical vertebrae showed accessory foramen in posterior aspect of foramina transversaria. (Figure 2D) Two cervical vertebrae showed accessory foramina in anterior aspect of Foramen transversarium. (Figure 3A)

One cervical vertebra showed equally divided Foramen transversarium (Figure 3B).One cervical vertebra showed bilateral posteriorly placed accessory foramen (Figure 3C). One atlas vertebra showed unilateral right sided arcuate foramen (Figure 3D).

Time Schedule of activities giving milestones through BAR diagram. (Maximum of 1/2 pages)

S. No	Activity/ mile stolen	1st Year			
1	Literature review	**1-3 month**			
2	Analysis of existing work	-	**4-6month**		
3	Designing & work initiated	-	-	**7-9 month**	
4	Statistics & Discussion with results	-	-	-	**10-12**



4.2 Expected outcome within the time period of See Money Scheme

Features of the atlas vertebra must be familiar before any spinal surgeries such as transpedicular screw fixation, transarticular screw fixation, interspinous wiring, and interlaminar clamp. In the present study significant number of variations among foramina transversaria were found. The incidence of accessory foramen transversarium appears to be very high. One unilateral Arcuate canal (posterior arch canal) was identified. These information will be helpful in avoiding and reducing complications such as vertebral artery injury, spinal cord injury during spine surgeries. For neurosurgeons and radiologists, the surgical anatomy of these variations is important for interpreting the CT and MRI scans and essential while performing complex surgical procedures. Their morphological knowledge is clinically important since the course of the 2nd and 3rd part of vertebral artery may be distorted. These variations may be one of the causes for complaints like headache, migraine and fainting episodes due to vertebral artery compression.

5. Suggested Plan of action stating the name of funding agency where the project will be communicated for financial support within the time period of project.

Nil

6. Bibliography: Nil

Nil

7. List of Projects submitted/implemented by the Investigators (Separate for Pi and Co-PI)

7.1 Details of Projects submitted to various funding agencies:

S.No	Title	Cost in Lakhs	Month of Submission	Role as PI/Co-PI	Agency	Status
	NA	NA	NA	NA	NA	NA

7.2 Details of Projects under implementation

Sl. No.	Title	Cost in lakhs	Duration	Role as PI/ Co-PI	Agency
	NA NA	NA	NA	NA	NA

7.3 Details of Projects completed during the last 5 years

Sl. No.	Title	Cost in lakhs	Duration	Role as PI/ Co-PI	Agency
	NA	NA NA	NA	NA	NA

8. List of publications published by the Investigators, if any:

a) Principal Investigator

S. No	Author names	Title of paper	Name of Journal	Vol (issue)	Page no.	Year
1	Mary Hydrina D'Silva1, Rijied Thompson Swer2, J. Anbalagan3, **Bhargavan Rajesh 4**	Effect of Radiofrequency Radiation Emitted from 2G and 3G Cell Phone on Developing Liver of Chick Embryo – A Comparative Study	Journal of Clinical and Diagnostic Research	11(7)	AC05 - AC09	2017
2.	M. Senthil Murugan,[1,*] R. Sudha,[1] and **Rajesh Bhargavan[2]**	Clinical Significance of an Unusual Variation Anomalous additional belly of the sternothyroid muscle	Sultan Qaboos University Med J,	16(4)	e491–494,	2016
3.	Mary Hydrina D'Silva,1 Rijied Thompson Swer,1 J. Anbalagan,1 and **Rajesh Bhargavan2**	Effect of Ultrahigh Frequency Radiation Emitted from 2G Cell Phone on Developing Lens of Chick Embryo: A Histological Study	Advances in Anatomy	10(2)	1-9	2014
4.	Vasudev Anand Rao, Subashini Kaliaperumal, Thanikachalam Subramanyan, Kotapalli Rachandra Rao, **Rajesh Bhargavan**	Goldenhar's sequence with associated juvenile Glaucoma in turner's syndrome	Indian Journal Of Ophthalmology	53(4)	267-268	2005

b). Co-Principal Investigator

S.No	Author names	Title of paper	Name of Journal	Vol (Issue)	Page No.	Year
1.	**1N.Anandaramajayan*,** 2K.C.Mallikarjuna.	Fused Typical Cervical Vertebra – A Case Report	Journal of Current Trends in Clinical Medicine & Laboratory Biochemistry	2(4)	64-66	2015
2.	**1N.Anandaramajayan*,** 2B.Rajesh.	Unilateral Renal Agenesis with variations in the vascular pattern of Testis, Supra Renal Gland And Diaphragm -A Case Report	Journal of Current Trends in Clinical Medicine & Laboratory Biochemistry	2(2)	66-72	2014
3.	1B. Rajesh*, **2N.Anandaramajayan,** 2V.Santhi, 3K.C. Mallikarjuna,3S.I. Tolanur, 4R. Praveen Kumar	An abnormal radicle of Median Nerve from Musculocutaneous nerve in the Arm	Journal of Current Trends in Clinical Medicine & Laboratory Biochemistry	1(2)	34-36	2013

9. Budget

Sl. No	**Head**	**Amount in INR**
1	BP Apparatus, Stethoscopes, Body weight weighing machine, SPSS version 16 Chicago, IL, USA, ECG machine	50000
2	Consumables (gels bottels, cotton, sprit, testing charges, tools, etc.)	5000
3	Travel support for the purpose of research work.	10000
4	Contingency	25000
5	Others consumables	10000
	Total	1,00,000

*In case of any joint proposal for purchasing a same equipment, each of the associated PLs is also required to give separate budget (without any clubbing) to avoid any ambiguity, if all the associated projects are not awarded by committee.

10. Name of at least two subject experts from the Institute and one from the outside Institute with their contact details:

1. **Dr. M. Sivakumar** Professor Dept. of Anatomy JIPMER, Puducherry **Mobile No**: 9994264019 **E-mail id:** sivakumar96@yahoo.com	2. **Dr. J Anbalagan** Professor of Anatomy Mahatma Gandhi Medical College and Research Institute, Pondicherry **Mobile No**: 9443500366 **E-mail id:** jayaramanbalagan@gmail.com

CERTIFICATE FROM THE INVESTIGATOR

Project Title: Variations among Foramen Transversarium in Cervical Vertebrae and its Clinical Significance

It is certified that

1. I do hereby agree to submit a complete proposal for financial support to the external funding agency within the time period of SMS-2015.
2. I undertake that spare time on equipment procured in the project will be made available to other users.
3. I agree to submit a certificate from Institutional Biosafety Committee, if the project involves the utilization of genetically engineered organisms. I also declare that while conducting experiments, the Biosafety Guidelines of Department of Biotechnology, Department of Health Research, GOI would be followed in to.
4. I agree to submit ethical clearance certificate from the concerned ethical committee, if the project involved field trails/experiments/exchange of specimens, human & animal materials etc.
5. I agree to abide by the terms and conditions of SMS-2015, BIHER, and Chennai.

Name and signature of
Principal Investigator

Name and signature of
Co-Principal Investigator

Date: 19.01.2017
Place: Pondicherry

Forwarded by Head of the Department

Signature of the Head

DEAN
SRI LAKSHMI NARAYANA INSTITUTE OF MEDICAL SCIENCES
OSUDU, AGARAM VILLAGE,
KOODAPAKKAM POST,
PUDUCHERRY - 605 502

PROJECT EVALUATION FORMAT

Recommendation sheet

Name of the Principal Investigator	Dr. B Rajesh
Name of the Co-Principal Investigator	N. Anandaramajayan
Name of the Department	Anatomy
Title of project	Variations among Foramen Transversarium in Cervical Vertebrae and its Clinical Significance
Recommendation of the evaluation committee (Recommended/Revision/Not Recommended)	Recommended
Financial allocation recommended	Rs. 100000/-

SI. No.	Head	Amount
1	BP Apparatus, Stethoscopes, Body weight weighing machine, SPSS version 16 Chicago, IL, USA, ECG machine	50000
2	Consumables- Gel bottles, cotton, sprit, testing charges, tools, etc.	5000
3	Travel support for the purpose of research work.	10000
4	Contingency	25000
5	Others consumables	10000
	Total	**1,00,000**

Name and Signature of the Research Advisory Committee members with date

Dr. G. Jayalakshmi

Internal Quality Assurance Cell IQAC Pondicherry-01 SLIMS