Original article

Incidence of metopic suture in skulls of Northeastern Thai adults

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Objectives To identify the incidence of metopic sutures and their variations in shape, as well as the risk factors in northeastern Thai adults.

Methods A cross sectional analytic study was conducted in the Human Anatomy Laboratory at the College of Medicine and Public Health, Ubon Ratchathani University. The skulls of 52 embalmed human cadavers and 27 dry skulls of northeastern Thai adult subjects were examined. Data were collected using a form for record keeping created by an anatomist. The descriptive and inferential statistics were analyzed by SPSS version 16.0 for Windows.

Results The skulls studied showed that the occurrence percentage of metopic suture was 20.3%, of which 81.2% were male and only 18.8% female. Metopism was found in 50% of the skulls examined. The frequency found in male skulls (62.5%) was higher than that seen in female ones (37.5%). Incomplete metopic sutures were found in 50% of the skulls, showing morphological variations of a U and V shape, which were seen to be equal in frequency at 25%. Different incidences of metopic sutures were associated with gender and types of subjects.

Conclusions This study showed the incidence of metopic sutures in Thai adults, which should be noted for the fields of radiology and forensic medicine. **Chiang Mai Medical Journal 2013;52(1-2):11-16.**

Keywords: metopic suture, metopism, skull

Introduction

Sometimes, two halves of the frontal bone in the human skull is located along the midlineundergo intramembranous ossification. Normally, this is close to the condroid tissue for only a short time during the second year of life (Figure 1). However, in some cases the frontal bone fails to close, and this is known as metopic suture [1, 2]. There are two types of metopic suture. Firstly, one that extends from the nasion to bregma, which is called a complete metopic suture or metopism. Secondly, an incomplete

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Received June 1, 2013, and in revised form 13 September, 2013.

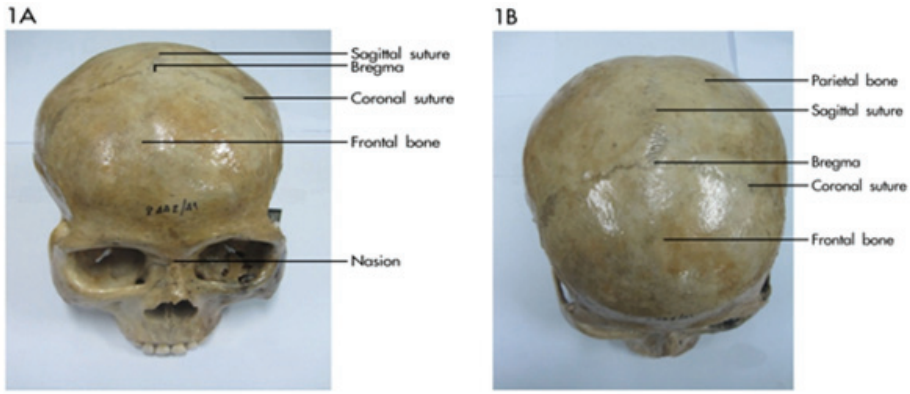

Figure 1. Normal skull; 1A= Anterior view; 1B= Top view

metopic suture that varies in shape with a U, V, Y or linear form [3-5]. There are many reported incidences of metopic sutures, of which a variety of races have been connected such as Nigerians, Brazilians, Nepalese, Lebanese, Poles, Turks [4-9] and Indians [10-16]. The inci-dence of metopic sutures in adult human skulls was as follows: 64.1% in Indians [12], 55% and 45% in southern Indians [14,16], 48% in Belgians, 48% in Kanataka Indians [15], 39.4% in southern Brazilians [5], 39% in groups of children with positional plagiocephaly [13], 38.5% in Nigerians [4], 18.04% in northen Indians [11], 11.46% in Nepalese [6], 1.75% in Lebanese [7] and 0.1% in an autopsy in northern India [10]. Gender plays an important role in metopic suture expression. It was shown from a previous study that the Lebanese population had a greater incidence of metopic sutures in males rather than females [7]. This was found also in Indian skulls [10,12,15]. Conversely, Brazilian females showed a higher incidence than Brazilian males [5]. Previous studies revealed that most of the skulls had shown both complete and incomplete types of metopic sutures, such as those in Nigerians, Brazilians, Lebanese, Nepalese [4-7], and Indians [11-12, 14-16]. However, some studies have shown that complete metopic sutures only occurred in Turks and northern Indians [9, 10]. There are no reports of metopic suture in the adults of northeastern Thailand. The results of this study are important for the fields of radiology and forensic medicine. This study attempted to identify the incidence of metopic sutures and their variations in shape as well as their risk factors in northeastern Thai adults.

Methods

A cross-sectional analytic study was conducted in the Human Anatomy Laboratory at the College of Medicine and Public Health, Ubon Ratchathani University.

This study was conducted with the human skulls of 52 embalmed cadavers and 27 dry skulls from the Department of Anatomy, Faculty of Medicine, Khon Kaen University, thus comprising a total of 79 adult subjects from northeastern Thais. These subjects consisted of 46 males and 33 females with ages ranging from thirty five to eighty five years. The dissections of the embalmed cadavers were carried out on the anterior part of the frontal bone in order to identify the metopic suture. The data were collected by using a record keeping form created by an anatomist. The descriptive and inferential statistics were analyzed by SPSS (version 16.0) for Windows.

Results

From the total of 79 subjects examined, 46 (58.2%) were male and 33 (41.8%) female. More than half of the subjects (65. 8%) were cadavers. Of the skulls studied from the total number of subjects examined, metopic suture was seen to occur in 20.3% (16/79). Of those, 81.2% (13/16) were male and only 18.8% (3/16) female. Metopism (Figure 2) was found in 50% (8/16), with a higher frequency in male skulls at 62.5% (5/8), as compared to female skulls at 37.5%

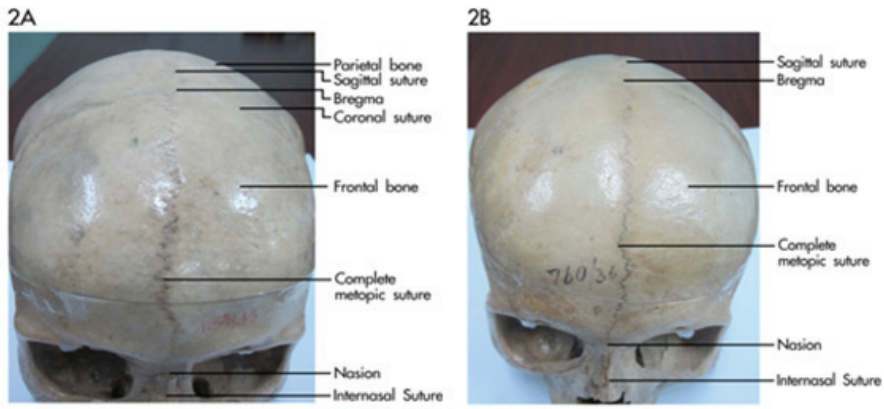

Figure 2. Complete metopic suture; 2A= Anterior view 2B =Top view.

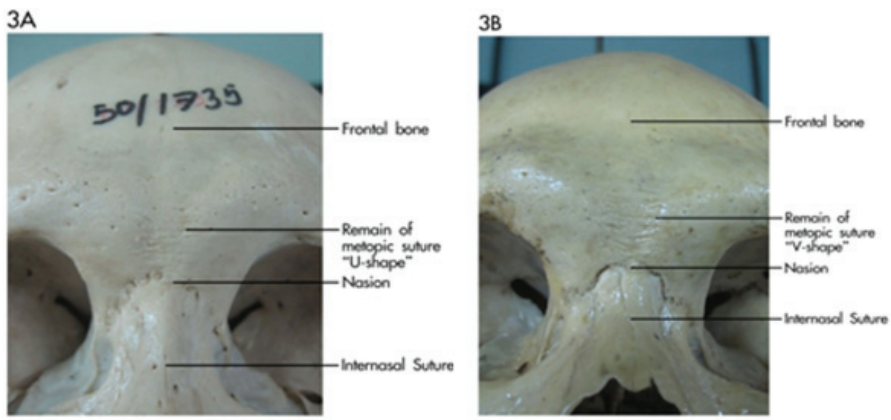

Figure 3. Incomplete metopic suture; 3A= U shaped; 3B = V shaped.

(3/8). Incomplete metopic suture was found in 50% (8/16). Sutures showing morphological variations, and the U and V shape (Figure 3) occurred with equal frequency at 25% (4/16). Different incidences of metopic sutures were associated with gender. Males were affected more significantly with an incidence 3.9 times greater than that of females (95% CI = 1.02: 15.18). Additionally, the type of subjects, such as the dry skulls, was affected significantly, with an incidence 5.78 times greater than that in the embalmed cadavers (95%CI = 2.06:16.21), as shown in the table.

Discussion

This study describes the incidence of metopic sutures in northeastern Thai adults (20.3%), which was similar to that of northern Indians [11]. Indians presented at 64.1%, 55%, 48% and 45% [12, 14-16], Brazilians at 39.4% [5], north Americans at 39% [13], and Nigerians at 38.5%. [4]. In contrast, lower incidence rates were reported in Nepalese at only 11.46% [6], Lebanese at 1.75% [7], and an autopsy in India at 0.1% [10]. Demographics and race might affect this phenomenon. This study showed an association between gender and incidence of metopic sutures, where the incidence in males was 3.9 times greater than that for females, which was similar to a previous study performed on Lebanese [7] and Indian subjects [10,12,15]. On the other hand, Brazilian females showed a higher incidence than Brazilian males [5]. This study found that both complete and incomplete metopic sutures in Thailand were similar to those in previous studies performed on Nigerians [4], Brazi-

Table 1. Characteristics of subjects and incidence of metopic suture

Characteristics	Subjects		Metopic suture	
	Number [n=9]	Percentage	Number [n=16]	Percentage
Gender				
Female	33	41.8	3	18.8 (9.1)
Male	46	58.2	13	81.2 (28.3)
Type of Subjects				
Cadaver	52	65.8	4	25 (7.7)
Dry Skull	27	34.2	12	75 (44.4)
Metopic Suture				
Absence	63	79.7		
Presence	16	20.3		
- Complete			8	(50)
- Incomplete				
U-shape			4	(25)
V-shape			4	(25)

lians [5], Lebanese [7], Nepalese [6], Indians [12], northern Indians [11] and southern Indians [14,15,16]. However, results from Turkish and northern Indian subjects differed because only metopism was reported [9, 10]. Cavarial suture obliteration is associated with increased osteoblast proliferation and reduced suture cell apoptosis, which is induced by growth factors such as fibroblast growth factor 2 (Fgf2), bone mophogenic protein4 (Bmp4) and transforming growth factor-beta2 (Tgf-β2) [17-20]. Conversely, the cause of metopic suture in humans might stem from transforming growth factor-beta3 (Tgf-β3). A previous study revealed that in vivo Tgf-β3 delayed fusion of the posterior inter-frontal suture in Spraque-Dowley rats [21]. Due to a misdiagnosed case in Turkey of a vertical traumatic skull fracture extending in the mid-line of a head trauma patient in an emergency setting [9], this knowledge of abnormal frontal bone should be noted for the fields of radiology and forensic medicine. Reconstructed tomography scans may provide the value of additional information in the diagnostic sequence, which would be superior to a common X-ray. Furthermore, the association between gender and abnormalities of metopic sutures should be investigated further by systematic review and meta-analysis.

Acknowledgement

We would like to express our gratitude to all the subjects dedicated to this study. In addition, the authors report no conflict of interest.

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อุบัติการณ์ของเมโตปิกซูเจอร์ (metopic suture) ในประชากรภาคตะวันออกเฉียงเหนือของประเทศไทย

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บทนำ โดยปกติกะโหลกศีรษะส่วนหน้าจะมีการเจริญเติบโตแบบ intramembranous ในแนวกลางและจะปิดสนิทในขวบปีที่สอง อย่างไรก็ตามการเจริญเติบโตนี้มีโอกาสเกิดความผิดปกติที่กระดูกส่วนหน้าเชื่อมต่อกันไม่สนิท เรียกว่า เมโตปิกซูเจอร์ (metopic suture) อาจพบได้ทั้งแบบสมบูรณ์และแบบไม่สมบูรณ์ ซึ่งมีความสำคัญต่อการวินิจฉัยทางรังสีวิทยาและนิติ-วิทยาศาสตร์ในการแยกรอยโรคของกะโหลกศีรษะอื่นๆ อีกทั้งในประเทศไทยยังไม่มีรายงานการศึกษาเรื่องเมโตปิกซูเจอร์

วัตถุประสงค์ เพื่อศึกษาอุบัติการณ์ รูปร่าง ลักษณะและปัจจัยเสี่ยงของการเกิดเมโตปิกซูเจอร์ในประชากรภาคตะวันออกเฉียงเหนือของประเทศไทย

วิธีการศึกษา เป็นการศึกษาภาคตัดขวาง (cross-sectional study) โดยทำการศึกษากะโหลกศีรษะของอาจารย์ใหญ่ในห้องปฏิบัติการมหกายวิภาคศาสตร์ วิทยาลัยแพทยศาสตร์และการสาธารณสุข มหาวิทยาลัยอุบลราชธานี จำนวน 79 ราย เก็บข้อมูลด้วยแบบบันทึกข้อมูลโดยนักกายวิภาคศาสตร์ วิเคราะห์ข้อมูลสถิติเชิงพรรณนาและสถิติเชิงอนุมานด้วยโปรแกรม SPSS 16.0

ผลการศึกษา พบการเกิดเมโตปิกซูเจอร์ ร้อยละ 20.3 ของจำนวนกะโหลกศีรษะทั้งหมด แบ่งเป็นเพศชายร้อยละ 81.2 และเพศหญิงร้อยละ 18.8 เมื่อพิจารณาตามลักษณะการเกิดเมโตปิกซูเจอร์ พบเมโตปิกซูเจอร์แบบสมบูรณ์ (metopism) ร้อยละ 50.0 โดยพบมากในกะโหลกศีรษะเพศชายร้อยละ 62.5 เพศหญิงร้อยละ 37.5 และการเกิดเมโตปิกซูเจอร์แบบไม่สมบูรณ์ (incomplete metopic suture) ร้อยละ 50.0 แบ่งเป็นรูปร่าง U และ V จำนวนเท่ากันร้อยละ 25 นอกจากนี้ยังพบว่าเพศมีความสัมพันธ์กับการเกิดเมโตปิกซูเจอร์ **เชียงใหม่เวชสาร 2556;52(1-2):11-16.**

คำสำคัญ: เมโตปิกซูเจอร์ การเกิดเมโตปิกซูเจอร์แบบสมบูรณ์ กะโหลกศีรษะ