The complications of basilar skull fracture in mild head injury patients

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Introduction

Objective

Diagnosis of basilar skull fracture requires high resolution head computer tomography (CT) scan which takes up high costs and usually not available in most hospital. This study aim to find prevalence of intracranial hemorrhage and other complications in patient with basilar skull fracture from mild traumatic head injury to determine the need of head CT scan.

Methods

In a retrospective descriptive study, all patients age 15 years old or more who presented to emergency department with mild traumatic head injury and had signs of basilar skull fracture were enrolled. Diagnosis of basilar skull fracture was confirmed by head CT scan. We collected data from January, 2009 to September, 2012 to analyze and report complications of basilar skull fracture.

Results

Mild head injury patients who had basilar skull fracture confirmed by head CT scan and had symptoms of basilar skull fracture 65 cases were include in study. Complications were found in 61 patients (95.4%). Most complications were intracranial hemorrhage and cranial nerve compression which were found in 70.5% and 9.8% respectively. Among these patients, 12 (19.7%) were underwent cranial surgery. In patients who were performed head CT scan due to signs of basilar skull fracture, 70.3% of patients had complication. Signs of basilar skull fracture occurred in 58% of patients whom basilar skull fracture confirmed by head CT scan. The median length of hospital stay was 4 days.

Conclusion

Mild traumatic head injury patients who present with signs of basilar skull fracture has high rate of complication and considerable number of this group need surgical treatment. Therefore, head CT scan should be performed in all mild traumatic head injury patient who has any signs of basilar skull fracture.

Keywords

mild head injury, basilar skull fracture, complication, head CT scan

ภาวะแทรกซ้อนของการมีกระดูกฐานกะโหลกศีรษะแตกร้าวในกลุ่มผู้ป่วยบาดเจ็บที่ศีรษะแบบไม่รุนแรง

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บทคัดย่อ

บทนำ

การวินิจฉัยภาวะกระดูกฐานกะโหลกศีรษะแตกร้าวสามารถทำได้จากการเอกซเรย์คอมพิวเตอร์สมองความละเอียดสูง แต่มีข้อจำกัดคือค่าใช้จ่ายสูงและไม่สามารถทำได้ทุกโรงพยาบาลงานวิจัยนี้จึงมีวัตถุประสงค์เพื่อศึกษาถึงความชุกของการเกิดเลือดออกในกะโหลกศีรษะและภาวะแทรกซ้อนอื่นๆ ของกระดูกฐานกะโหลกศีรษะแตกร้าวในกลุ่มผู้ป่วยบาดเจ็บที่ศีรษะแบบไม่รุนแรง เพื่อพิจารณาถึงความจำเป็นของการส่งตรวจเอกซเรย์คอมพิวเตอร์สมอง

วิธีการวิจัย

การศึกษาวิจัยเชิงพรรณนาแบบย้อนหลัง โดยรวบรวมข้อมูลผู้ป่วยอายุตั้งแต่ 15 ปีขึ้นไปที่ได้รับบาดเจ็บที่ศีรษะแบบไม่รุนแรงและได้รับการวินิจฉัยภาวะกระดูกฐานกะโหลกศีรษะแตกร้าวจากเอกซเรย์คอมพิวเตอร์สมองที่โรงพยาบาลมหาราชนครเชียงใหม่ร่วมกับมีอาการแสดงของภาวะกระดูกฐานกะโหลกศีรษะแตกร้าว ในช่วงเดือนมกราคม พ.ศ. 2552 ถึงเดือนกันยายน พ.ศ. 2555 มาวิเคราะห์ และรายงานผล การเกิดภาวะแทรกซ้อนของภาวะกระดูกฐานกะโหลกศีรษะแตกร้าว

ผลการวิจัย

ผู้ป่วยบาดเจ็บที่ศีรษะแบบไม่รุนแรงที่ได้รับการวินิจฉัยภาวะกระดูกฐานกะโหลกศีรษะแตกร้าวจากเอกซเรย์คอมพิวเตอร์สมองร่วมกับมีอาการหรืออาการแสดงของภาวะกระดูกฐานกะโหลกศีรษะแตกร้าวเข้าเกณฑ์การศึกษาทั้งหมด 65 ราย, มีภาวะแทรกซ้อน 61 ราย (ร้อยละ 95.4) ภาวะแทรกซ้อนที่พบบ่อยที่สุดได้แก่ เลือดออกในกะโหลกศีรษะ 43 ราย (ร้อยละ 70.5) และเส้นประสาทสมองถูกกดทับ 6 ราย (ร้อยละ 9.8) มีผู้ที่ได้รับการผ่าตัดกะโหลกศีรษะ 12 ราย (ร้อยละ 19.7) และในกลุ่มที่ได้รับการเอกซเรย์คอมพิวเตอร์สมองเนื่องจากมีอาการแสดงของกระดูกฐานกะโหลกศีรษะแตกร้าวเพียงอย่างเดียวพบภาวะแทรกซ้อนร้อยละ 70.3 ผู้ป่วยที่มีอาการแสดงของกระดูกฐานกะโหลกศีรษะแตกร้าวคิดเป็นร้อยละ 58 ของผู้ป่วยที่พบกระดูกฐานกะโหลกศีรษะแตกร้าวจากเอกซเรย์คอมพิวเตอร์สมอง ค่ามัธยฐานจำนวนวันที่นอนโรงพยาบาลคือ 4 วัน และไม่พบผู้ป่วยที่มีเยื่อหุ้มสมองอักเสบติดเชื้อภายใน 2 สัปดาห์หลังได้รับบาดเจ็บ

สรุป

ผู้ป่วยที่มีกระดูกฐานกะโหลกศีรษะแตกร้าวในกลุ่มบาดเจ็บที่ศีรษะแบบไม่รุนแรงพบภาวะแทรกซ้อนได้บ่อยและพบภาวะแทรกซ้อนรุนแรงจนต้องได้รับการผ่าตัด ดังนั้นผู้ป่วยที่มีอาการแสดงของกระดูกฐานกะโหลกศีรษะแตกร้าวควรได้รับการเอกซเรย์คอมพิวเตอร์สมองทุกราย

คำสำคัญ

บาดเจ็บที่ศีรษะแบบไม่รุนแรง, กระดูกฐานกะโหลกศีรษะแตกร้าว, ภาวะแทรกซ้อน, เอกซเรย์คอมพิวเตอร์สมอง

Introduction

Basilar skull fracture can be found in 21% of total skull fracture patients[1] and account for 4% of head injury patients. In all head injury patients, mild head injury patients account for 43%.[2] Basilar skull fracture is any fracture of temporal, occipital, ethmoid and sphenoid bone by literature review of Erol Tas and Roy A. Patchell.[3] Diagnosis of basilar skull fracture cannot made solely by plain skull film. In the past, diagnosis was made by using signs and symptoms such as cerebrospinal fluid (CSF) otorrhea/rhinorrhea, hemotympanum, a raccoon eyes sign, post-auriculararecchymosis/Battle's sign or cranial nerve palsy. In present, diagnosis can be made by using high resolution computed tomography (high resolution CT) which has up to 94% sensitivity for basilar skull fracture[2], but some limitations are highly cost and not available in most hospitals. Due to these limitations, patient admission to observational unit for observation of signs and symptoms is still necessary in some area. Basilar skull fracture patients might have complications such as bacterial meningitis, cranial nerve injury, pituitary endocrinopathies, traumatic internal carotid aneurysms, carotid-cavernous fistulas, Horner's syndrome. Moreover the other intracranial injuries can be found such as intracranial hemorrhage, cerebral contusion, eye fracture and facial skull fracture[4-9]. Signs and symptoms of intracranial hemorrhage show up after accident up to 6 days.[10]Most of them could be found in first 72 hours; 35% in 24 hours and 80% in 72 hours.[11]

Mainstay treatment of basilar skull fracture are conservative treatment. Even some significant complications such as meningitis could be found up to 9-17.8% and may rise up to 50% in patient who has CSF leakage[4], previous studies found that surgery doesn't make difference in treatment outcome in first week[1]. So patients who have no complications that need surgery such as intracranial hemorrhage or cranial nerve compression should receive conservative treatment. Effectiveness of antibiotics use in basilar skull fracture was reviewed in meta-analysis study and found not effective in meningitis prevention for basilar skull fracture patients who have CSF leakage4. Risk of infection will increase significantly if leakage of CSF is longer than 7 days[12].

The study on necessary for admission indicate that children who have GCS 15 and no complication could be treat as outpatient, whereas the results in adult patient still not certain.[13] The Royal College of Surgeons of Thailand recommended to admit patients of this group for hospital care for all age groups[14]. The complications of basilar skull fracture are relatively rare, some specialists believe that head CT scan would not necessary to perform for patients who have no signs of basilar skull fracture. Classification by Royal College of Surgeons of Thailand, mild head injury patient is patients who have GCS 13-15[14]. The emergency department of Maharaj Nakorn Chiang Mai Hospital use the guideline that modified from Neurotraumatology Committee of the World

Federation of Neurological Societies (NCWFNS) 2001 which classify mild head injury patient as GCS 14-15 by the studies of Van Baalen et al.[15], Mena JH et al.[16] and Servadei et al.[17] These studies confirm that the classification is more suitable.There was limited number of studies to confirm necessary of head CT scan for mild injury patients with skull base fracture, recommendation mainly come from expert opinions. Because complications of skull base fracture might not be diagnosed clinically and might be dangerous if not treated promptly. Renick DK et al, found that internal carotid aneurysms could happen without any symptoms until bleeding to death which usually occur in skull fracture around petrous especially carotid canal[18]. Thomas Kral el al. show that basilar skull fracture patients have internal bleeding in skull for 86% but not classify for level of injury (mild/moderate/severe head injury)[2]

This study aim to find prevalence of intracranial hemorrhage and other complications in patient with basilar skull fracture from mild traumatic head injury to determine the need of head CT scan.

Methods

This retrospective descriptive study collected data from hospital information system database of Maharaj Nakorn Chiang Mai since January 2009 to September 2012 and analyzed for complications of basilar skull fracture patients who was diagnosed by head CT scan which was done and interpreted by radiologists. At least 40 cases of patients who had complications of basilar skull fracture were needed by sample size calculation as described in supplement1. All mild head injury patients (GCS 14-15) age 15 years and older who presented to emergency department with signs of basilar skull fracture such as CSF rhinorrhea/otorrhea, hem tympanum, bloody otorrhea, raccoon eyes, Battle's sign were included to determine for any complications such as intracranial hemorrhage, CSF leakage, cranial nerve injury, meningitis[19]. Patients who information cannot retrieve from database were excluded.

Data analysis

All data were analyzed and reported using descriptive statistical information such as percentage, ratio and mean value depend on type of data. Mean and standard deviation were used for continuous data with normal distribution, median and IQR (Interquartile range) were used for continuous data with non-normal distribution data. Data were analyzed by Microsoft office excel 2010 to indicate occurring of complications in basilar skull fracture patients.

Results

Patients who had basilar skull fracture confirmed by head CT scan in Maharaj Nakorn Chiang Mai Hospital from January 2009 to September 2012 were 393 cases, 44 patients were excluded due to age below 15 years and incomplete data, 349 patients were included to study in which 145 cases had severe injury, 92

cases were moderate injury and 112 cases were mild injury. For 112 cases in mild injury group , there were 65 patients (58%) who had signs/symptoms of basilar skull fracture which were male 49 patients and median age was 29 years old (table 1).

Table 1. Characteristics of basilar skull fracture patients

Characteristic	Number of cases (n=65)	Percentage (%)
Gender		
Male	49	75.4
Female	16	24.6
Age years, median (IQR)	29 (23,44)	
Initial GCS		
14	19	29.2
15	46	70.8
Mechanism of injury		
Traffic accident	57	87.7
Falling from height	3	4.6
Fallingfrom same level	2	3.1
Body assault	2	3.1
Being shoot	1	1.5
Indication of head CT scan		
Signs of basilar skull fracture	37	56.9
GCS drop or not improve after observation	15	23.1
Presence of skull fracture on plain film	8	12.3
Seizure	2	3.1
Focal neurological deficit	3	4.6
Other injury on the heador face, N (%)	49 (75.4%)	
Maxillofacial bone fracture	29	59.2
Ear injury	6	12.2
Eye injury	8	16.3
Cranial nerve injury	6	12.2
Other injury on the body	24	36.9
Day of hospitalization,median (IQR)	4 (2,8)	

Most injuries come from traffic accident (57 cases, 87.7%). Most common indication for head CT scan were signs of basilar skull fracture (37 case,56.9%) and decreased of GCS or worse condition (31 case,47.7%) and median length of hospitalization was 4 days. There were complications found for 61 cases (93.8%) which had GCS 14 for 19 cases (31.1%) and had GCS 15 for 42 cases (68.9%), had intracranial hemorrhage for 43 cases (70.5%), had CSF rhinorrhea/otorrhea for 3 cases, no patient had meningitis within 2 weeks. (table 2).

Table 2 Complicationsfound in mild injury group who had signs/symptoms of basilar skull fracture, n=61

GCS	Complication *	Number of case Case (%)
GCS 14 (n=19)	Intracranial hemorrhage	15 (78.9)
	CSF leakage	3 (15.8)
	Cranial nerve injury	2 (10.5)
	Meningitis	0 (0.0)
	Other¶	13 (68.4)
GCS 15 (n=42)	Intracranial hemorrhage	28 (60.9)
	CSF leakage	0 (0.0)
	Cranial nerve injury	4 (8.7)
	Meningitis	0 (0.0)
	Other¶	26 (56.5)

*One patient may have more than one complication, ¶other injury such as Eyeinjury, Ear injury, maxillofacial injury

For 61 cases who had complications, 12 cases (19.7%) were need for surgery account for GCS 14 for 4 cases, GCS 15 for 8 cases (table 3)

Table 3 type of surgery performed to patients

GCS 14	Surgery performed	Number of case
N = 4	Craniectomy/craniotomy	3
	Elevated skull	1
GCS15	**Surgery performed**	**Number of case ***
N = 8	Craniectomy/craniotomy	4
	Elevated skull	2
	Ventriculostomy	1
	Facial nerve decompression	2

*One patient may have more than one surgery

Among 37 cases who had head CT scan due to having signs of basilar skull fracture, there were intracranial hemorrhage 26 cases (70.3%) and 3 cases (8.1%) need for surgical treatment. For more detail of surgery performed, 1 case (2.7%) who had initial GCS 14 was operated for craniotomy and 2 case (5.4%) were operated for facial nerve decompression.

Discussion

From this study, among patients whom diagnosis of basilar skull fracture confirmed by head CT scan, patients who presented in emergency department with mild head injury and signs of basilar skull fracture have complication rate 93.8% which was intracranial hemorrhage for 70.5% and need for surgery up to 19.7%. The result consistent with the study of L Pretto Flores et al. which reported that signs of basilar skull fracture relate to intracranial injury and report that raccoon eyes sign give positive predictive values (PPV) for intracranial injury up to 78% follow by the Battle's sign up to 66% and bloody otorrhea for 41% in mild head injury. Furthermore the sign that most relate to intracranial injury is one-side raccoon eye which has positive predictive value up to 85% follow by both-side raccoon eyes up to 68% [20]. So, patients who have the signs of basilar skull fracture should be considered as high risk mild head injury and should perform head CT scan to evaluate for further management.

The patients included in this study was mild head injury which defined by Royal College of Surgeons of Thailand 14, Advanced Trauma Life Support (ATLS) 8th edition 21 and The Canadian CT Head Rules 22 as GCS 13-15 patients but emergency department of Maharaj Nakorn Chiang Mai Hospital use the guideline that modified from Neurotraumatology Committee of the World Federation of Neurological Societies (NCWFNS) 2001[17] which classify mild head injury patient as GCS 14-15 by studying of Van Baalen et al. which found that GCS 13 patients had complications as much as moderate head injury15. There is the study of Mena JH et al. compare the classification of ATLS in traditional and modified method, found that the traditional classification which GCS 13 was classified in moderate head injury is more suitable[13]. So, this study defined GCS 14-15 as mild head injury.

Among 37 patients who had head CT scan due to having signs of basilar skull fracture, 3 cases (8.1%) had severe complications that need surgical treatment with 1 fatality after the surgery. However, patients who present to emergency department with GCS 15 even they have intracranial hemorrhage up to 70.8% but none of them need for surgical treatment and no fatality. Because of limited number of basilar skull fracture cases from this study, further study with more sample size is required to confirm benefit of head CT can for evaluate intracranial hemorrhage and surgical need in this group of patient.

This retrospective study has some limitations such as data of hospitalization, some patients was refer back to local hospital so we cannot analyze number of hospitalize day.

Electronic database record had no complete information of basilar skull fracture's signs especially hemotympanum which need otoscopy for diagnosis. So the collection of data assumed that if there was no record, there was no signs of hemotympanum which may be underestimated. Also patients who had signs of basilar skull fracture but did not undergo head CT scan was not analyzed in this study. For further study, prospective study is preferable for more accuracy of data.

This research support that signs of basilar skull fracture should be one of the indications for head CT scan in mild head injury patients however this conclusion should be confirmed by further more sample size study.

Conclusion

Mild traumatic head injury patient (GCS 14-15) who present with signs of basilar skull fracture has high rate of complication and considerable number of this group need surgical treatment. Therefore, head CT scan should be performed in all mild traumatic head injury patient who has any signs of basilar skull fracture to evaluate complications and plan for appropriate treatment.

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