American Journal of Emergency Medicine xxx (2017) xxx–xxx

Contents lists available at ScienceDirect

American Journal of Emergency Medicine

journal homepage: www.elsevier.com/locate/ajem

Early vs late fracture fixation in severe head and orthopedic injuries

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ARTICLE INFO

Article history:
Received 11 December 2017
Received in revised form 27 December 2017
Accepted 28 December 2017
Available online xxxx

Keywords:
Head injury
Early fracture fixation
Late fracture fixation
Perioperative
Postoperative

ABSTRACT

Background: Patients suffered from craniocerebral trauma with extermities fracture is one of the most common multiple injuries.Actually there is no comparative study demonstrating advantages of early or delayed treatment of skeletal injuries.
Purposes: To conduct a meta-analysis with studies published in full text to demonstrate database to show the associations of perioperative, postoperative outcomes of early fracture fixation(EFF) and late fracture fixation(LFF) for patients with severe head and orthopedic injuries to provide the predictive diagnosis for clinic.
Patients and methods: Literature search was performed in PubMed, Embase, Web of Science and Cochrane Library for information from the earliest date of data collection to October 2017. Studies comparing the perioperative, postoperative outcomes of EFF with those of LFF patients with severe head and orthopedic injuries were included. Statistical heterogeneity was quantitatively evaluated by $\times^2$ test with the significance set $P < 0.10$ or $I^2 > 50\%$.
Results: Thirteen papers consisting of 2941 patients were included (1224EFF patients; 1717 LFF patients). The results showed that EFF was related to a greater increase in blood loss, intraoperative blood infusion, crystalloid, hypotension, hypoxia, length of surgery, non-neurologic complications and mortality($P < 0.1$). No differences in ICU days, hospital days, neurologic complications and GCS on discharge scores ($P > 0.1$).
Conclusions: Compared with LFF patients, EFF patients demonstrated an increased risk of perioperative and postoperative complications and clear difference about complications between EFF and LFF about patients with severe head and orthopedic injuries.
Level of evidence: Level IV, therapeutic study.

1. Introduction

Patients suffered from craniocerebral trauma with extermities fracture is one of the most common multiple injuries. A number of studies in orthopedic and neurosurgery literature have supported surgical fixation management of the patient with severe head [1-4]. This early fracture fixation has been shown to improve fracture outcome, and reduce perioperative, postoperative complications [5,6].

Recently, the reputed benefits of early fracture fixation have been challenged, study suggested for the first time that early operative stabilization may be deleterious in such patients [7-8]. Treatment and protection of the central nervous system is a priority in patients with a significant intracranial trauma. Secondary brain injury may exacerbate underlying head trauma and lead to further morbidity and disability (perioperative and neurologic outcome) [9-11].

Actually there is no comparative study demonstrating advantages of early or delayed treatment of skeletal injuries. Furthermore, the influence of early or delayed treatment in perioperative, postoperative outcomes of EFF and LFF for patients with severe head and orthopedic injuries is not established. Consequently, it is necessary to perform a comprehensive systematic review and meta-analysis that consists of all the studies to address the question of whether early fracture fixation is safe for patients with severe head injury. Therefore, the purpose of this study was to evaluate the association between EFF,LFF, perioperative and postoperative outcomes.

2. Materials and methods

2.1. Literature and search strategy

Two different reviewers independently searched the following electronic databases: PubMed, Embase, Web of Science and the Cochrane Library for information from databases inception to October 2017. The following related terms were searched: early fracture fixation; late fracture fixation; patients with severe head and orthopedic injuries; head trauma, intracranial trauma, brain injuries, fractures, fracture fixation, timing; Meta-analysis. Searching strategy was constructed by combining the above terms with “AND” or “OR”. No restrictions were imposed

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https://doi.org/10.1016/j.ajem.2017.12.067
0735-6757/

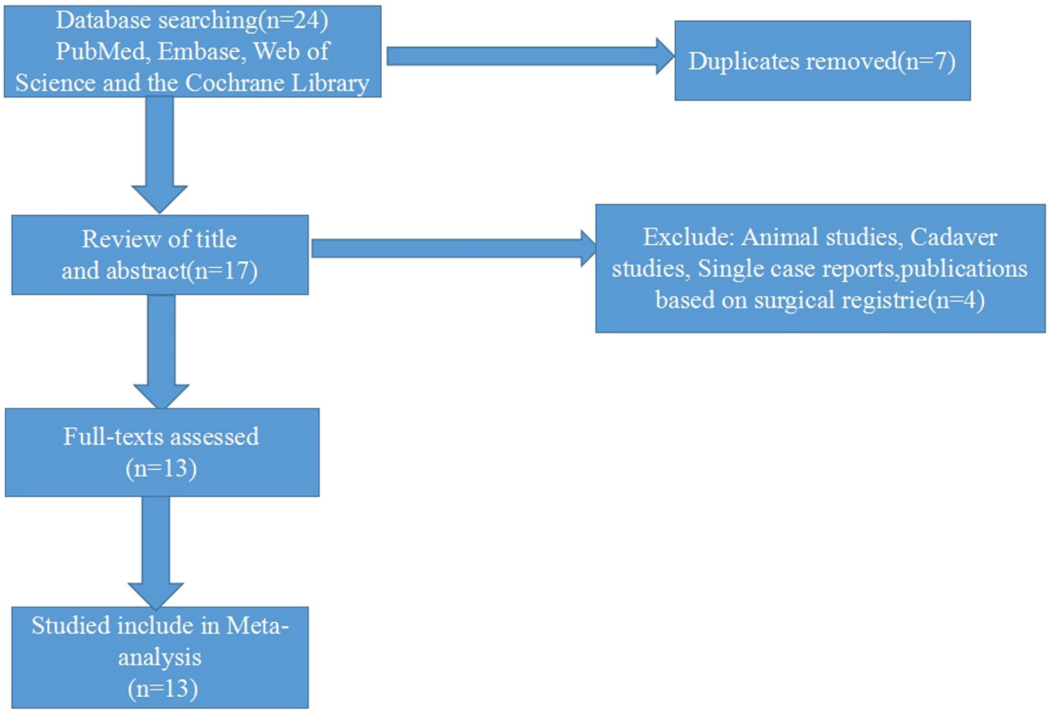

Fig. 1. a. Flow chart illustrating the literature search.

on the language of studies. We had also screened reference lists of retrieved articles, so that relevant studies were not missed.

2.2. Study selection criteria

Two different reviewers independently assessed the retrieved articles to determine whether they met the inclusion criteria. In case of disagreements, a third reviewer was involved in the discussion until a consensus was reached. The criteria for inclusion of papers selected for detailed review included the presence of a head injury, the presence of polytrauma, timing of stabilization of the skeleton, neurological assessment of patients, and English language. Exclusion criteria included: case-control studies, animal studies, cadaver studies, single case reports, comments, letters, editorials, protocols, guidelines, publications based on surgical registries, and review papers; for a clinical study, inclusion of fewer than 10 patients.

The patients were divided in the early fracture fixation (EEF) group when fixation took place within 24 h of admission and the late fixation (LEF) group when fixation was performed later. We analyzed the study type (randomized controlled trial, retrospective review, cohort studies) and treatment methods described. The sample size in each study was extracted from the information available. Injury severity indicators as available were identified and analyzed. These included the Glasgow Coma Scale (GCS), Abbreviated Injury Scores (AIS) for the head and orthopedic injuries, and the overall Injury Severity Score (ISS). Any complications of treatment, the overall length of hospital stay, blood loss intraoperative blood infusion. Infusing intraoperative Crystalloid intraoperative hypotension. Intraoperative hypoxia ICU days, GCS on discharge, hospital days and mortality rates were considered.

2.3. Data extraction and quality assessment

Two different reviewers independently performed data extraction and methodological quality assessment. Data extracted from the included studies consisted of authors, publication date, study design, number of patients, and outcome data in both early fracture fixation and late

Table 1
Summary of the characteristics of the included studies

References	Patients		ISS		GCS		Fractures stabilized		AIS head		AIS orthopedic	
	EFF	LFF	EFF	LFF	EFF	LFF	EFF	LFF	EFF	LFF	EFF	LFF
Bone 1994	676	906	18–60	18–60	3–15	3–15	Any bone	Any bone	N/A	N/A	N/A	N/A
Kalb 1998	84	39	33	31	9.7	9.9	Any bone	Any bone	4	3.9	2,9	2.6
Martens 1988	13	9	37	35	8	8	Femur, tibia and pelvis	Femur, tibia and pelvis	N/A	N/A	N/A	N/A
Velmahos 1998	22	25	25	23	5.8	5.7	Any bone	Any bone	3.8	3.4	2.9	2.4
Hofman 1991	15	43	Higher	Lower	<7	<7	Any bone	Any bone	N/A	N/A	N/A	N/A
Jaicks 1997	19	14	24	27	11.6	10.8	Any bone	Any bone	3.3	3.1	3.0	2.9
Poole 1992	46	26	27.6	33.9	12	10	Femur Tibia	Femur Tibia	N/A	N/A	N/A	N/A
Riemer 1993	160	447	23	22/26	N/A	N/A	Pelvis	Pelvis	N/A	N/A	N/A	N/A
Starr 1998	14	18	23.3–32	29.8–34.3	14.9–6.2	13.3–5.6	Femur	Femur	3.2–4.2	3.8–4.1	3	3
Townsend 1998	49	12	Mean	35	<8	<8	Femur	Femur	N/A	N/A	3	3
Xin Jiang 2014	21	15	24	27	6.4	6.3	Any bone	Any bone	N/A	N/A	N/A	N/A
Kotwica 1990	51	49	N/A	N/A	Similar	Similar	Femur (17) Tibia (27) Pelvis (7)	Femur (10) Tibia (36) Pelvis (3)	N/A	N/A	N/A	N/A
Huangyuan 1999	31	76	N/A	N/A	9	10	Any bone	Any bone	N/A	N/A	N/A	N/A
Yiping 2002	23	38	24	27	8	9	Any bone	Any bone	N/A	N/A	N/A	N/A

N/A = not available; EFF = early fracture fixation; LFF = late fracture fixation; ISS = Injury Severity Score; GCS = Glasgow Coma Scale; AIS = Abbreviated Injury Score.

Please cite this article as: Zhang Y, et al, Early vs late fracture fixation in severe head and orthopedic injuries, American Journal of Emergency Medicine (2017), https://doi.org/10.1016/j.ajem.2017.12.067