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Research Paper

Immediate weight-bearing as tolerated has improved outcomes compared to non–weight-bearing after surgical stabilisation of midshaft clavicle fractures in polytrauma patients

多發創傷患者鎖骨幹體中間骨折手術固定後即時可容忍負重相比非負重有改善的結果

Cunningham Brian [a, *, e], Tangtiphaiboontana Jennifer [b], Basmajian Hrayr [c], Mclemore Ryan [d], Miller Brian [a], Rhorer Anthony [a], Ortega Gilbert [a]

[a] Sonoran Orthopaedic Trauma Surgeons, Scottsdale, AZ, USA
[b] University of California San Francisco, Department of Orthopaedic Surgery, San Francisco, CA, USA
[c] Loma Linda University Medical Center, Loma Linda, CA, USA
[d] Clinical Outcomes and Data Engineering Technology, Phoenix, AZ, USA

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ABSTRACT

Background: Clavicle fractures are common injuries in the polytrauma population and frequently limit early mobilisation. This study evaluates the effect of immediate crutch weight-bearing (WB) in polytrauma patients after surgical stabilisation of a displaced midshaft clavicle fracture.
Methods: A retrospective review identified 26 polytrauma patients with operatively managed displaced midshaft clavicle fractures and a non–weight-bearing (NWB) lower extremity injury. Patients were allowed immediate WB after surgery or NWB. The primary outcome was total hospital length of stay. Statistical analysis was done using Mann–Whitney U test.
Results: The WB group had decreased total hospital length of stay (10.4 vs. 17.0 days, $p = 0.012$) and improved physical therapy score (3.9 vs. 2.9, $p = 0.054$) and postoperative length of stay (6.8 vs. 12.7 days, $p = 0.006$) compared with the NWB group.
Conclusions: Our data suggest that an immediate WB as tolerated protocol for polytrauma patients after surgical fixation of displaced clavicle fractures may decrease the overall length of stay.

中 文 摘 要

背景: 鎖骨骨折是多發性創傷中常見的損傷,常常限制早期運動。這項研究評估了即時拐杖負重在多發性創傷患者移位的鎖骨幹體中間骨折手術固定後的影響。
方法: 回顧性分析確定了26例多多發性創傷患者具有鎖骨幹體中間骨折手術固定和非負重下肢損傷。患者在手術即後時負重(WB)或非負重(NWB)。主要結果是總住院時間(TLOS)。統計學分析使用了Mann-Whitney U檢驗。
結果: WB組患者相比NWB組患者TLOS降低(10.4 vs. 17.0,$p = 0.012$),物理治療評分(3.9 vs. 2.9,$p = 0.054$)和術後住院時間(6.8 vs. 12.7天,$p = 0.006$)有改善。
結論: 我們的數據表明,多發創傷患者鎖骨幹體中間骨折手術固定後,即時可容忍負重方案可能會縮短總住院時間。

* Corresponding author. 640 Jackson Street, Saint Paul, MN, 55101, Mailstop 11503L, USA.
E-mail: brian.p.cunningham@healthpartners.com (B. Cunningham), Jennifer.tangtiphaiboontana@ucsf.edu (J. Tangtiphaiboontana), basmajianmd@gmail.com (H. Basmajian), ryan.mclemore@gmail.com (R. Mclemore), brianhmiller@gmail.com (B. Miller), rhorertr@gmail.com (A. Rhorer), gil_ortega@msn.com (G. Ortega).
[e] Present address: Regions Hospital, Department of Orthopaedic Surgery, St. Paul, MN, USA.

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Introduction

Clavicle fractures are common injuries accounting for roughly 3% of all fractures[1] and most commonly occur in the middle third with estimates at approximately 80%.[2] The highest incidence of clavicle fractures is in young adults with a bias towards men.[3] While midshaft clavicle fractures have been treated successfully with nonoperative management for decades,[2,4] several recent studies have shown superior results with operative management in specific patient populations.[5–7] Surgical treatment of midshaft clavicle fractures has also shown to be both cost effective[8] and with improved quality of life[9] compared with nonoperative treatment in fracture patterns that are completely displaced.

A large number of patients suffer midshaft clavicle fractures as a result of a high-energy mechanism with current estimates between 29 and 47%.[3,10] Recently, two separate studies retrospectively reviewed national trauma registries and concluded that 10% of severely injured patients sustain a midshaft clavicle fracture.[11] Early mobilisation has been shown to improve outcomes in polytrauma patients[12,13], and there is evidence that early weight-bearing (WB) also leads to improved outcomes and quicker healing in extra-articular fractures.[14] Polytrauma patients frequently have lower extremity injuries that limit their ability to ambulate without utilising assistive devices. Previous reports have demonstrated the benefit of immediate WB after open reduction and plate fixation of humeral shaft fractures, which subsequently expanded the indication for operative treatment to include polytrauma patients.[15] A previous study demonstrated improved functional outcomes in polytrauma patients with midshaft clavicle fractures that were treated surgically.[16] The high incidence of clavicle fractures in polytrauma patients suggest that immediate WB as tolerated postoperatively may lead to improved outcomes.

WB status after open reduction and internal fixation of clavicle fractures has been limited to non–weight-bearing (NWB) in the literature;[5,6] however, in the polytrauma population, a clear benefit exists for early ambulation with the use of an assistive device. The literature does not have any studies evaluating immediate WB after open reduction internal fixation of midshaft clavicle fractures. The goal of our study was to evaluate the effect of WB after operative fixation of displaced midshaft clavicle fractures in polytrauma patients with a concomitant NWB lower extremity injury. Our hypothesis was that polytrauma patients with a midshaft clavicle fracture that were treated operatively would have decreased the length of stay with immediate postoperative WB as tolerated versus a NWB protocol.

Materials and Methods

After Institutional Review Board (IRB) approval, a retrospective cohort study was conducted from August 2007 to November 2013. Inclusion criteria were skeletally mature patients with a midshaft clavicle fracture (OTA 15-B) and a lower extremity injury that required NWB (comminuted long bone, periarticular fracture, acetabular fracture or C-type pelvic ring injury). Exclusion criteria were open fracture, presentation Glasgow Coma Scale below eight, NWB upper extremity injury or lower extremity amputation. Thirty-six consecutive patients were reviewed and 26 patients met the inclusion criteria. Nine patients were excluded because the clavicle fracture was treated nonoperatively and one patient was excluded because of an amputation. After open reduction and plate osteosynthesis, 10 patients were allowed immediate WB as tolerated using crutches or a walker and 16 patients followed an NWB protocol. The surgical stabilisation was performed by one of three fellowship trained orthopaedic trauma surgeons, and the postoperative WB protocol was at the discretion of the treating surgeon. All patients were seen by a physical therapist at the earliest possible time, and both groups were provided the same motion protocol, unrestricted active and passive motion. The WB as tolerated group was allowed to use crutches or a walker to assist with mobilisation, and this was reinforced by physical therapy.

Primary outcome was total length of stay, defined as total time in hospital, with secondary analysis examining maximum mobility level at discharge, and time from surgery to discharge. Maximum mobility level at discharge was defined by using a physical therapy scoring system utilised at our institution (Table 1). Clavicle fractures were classified according to the AO/OTA classification. All patients were followed until union, which was defined as pain free motion with radiographic evidence of union.[5] Statistical analysis was done using Mann–Whitney U test, adjusted for ties, for length of stay data, maximum mobility level at discharge, and number of intensive care unit days. Patients were also evaluated by examining data regarding age, sex, mechanism of injury and revised trauma score.

Results

Twenty-six patients met inclusion criteria with 38% ($n = 10$) in the WB group and 62% ($n = 16$) in the NWB group. The mean patient age was 41.1 years (range 19–64 years) and 45.5 years (range 22–66 years) in the WB and NWB groups, respectively. There were similar proportions of smokers in each group (30% WB vs. 31.25% NWB, $p = 0.948$). Lower extremity fractures (Table 2) and revised trauma score was similar in both groups (11.3 WB vs. 11.3 NWB). Overall there were 58% 15-B1, 34% 15-B2, 8% 15-B3 fractures ($n = 15$, 9 and 2, respectively). Of the 10 patients in the WB group, 60% had 15-B1, 30% 15-B2 and 10% 15-B3 fractures ($n = 6$, 3 and 1, respectively). There were 56% 15-B1, 38% 15-B2 and 6% 15-B3 fractures ($n = 9$, 6 and 1 respectively) in the NWB group. The WB group had a shorter intensive care unit length of stay (4.5 WB vs. NWB 5.8 days, $p = 0.423$). The WB group had decreased total length of stay (10.7 vs. 17.5 days, $p = 0.012$) and decreased postoperative length of stay (6.8 vs. 12.7 days, $p = 0.006$) compared to the NWB

Table 1
Physical therapy score.

PT scoring system	Score
Ambulate independently	6
Ambulate with assistive device	5
Pivot	4
Sit to stand	3
Supine to sit	2
Bed rest/slide board	1

The function of each patient was evaluated by a physical therapist before discharge. The level of function was quantified using a scoring system based on the 6 levels of activity used at our institution. The therapist documented the maximum level of function at discharge and this was tabulated to compare the weight-bearing versus non–weight-bearing groups.

Table 2
List of non–weight-bearing lower extremity injuries in each cohort.

	WB*	NWB*
Pelvic ring	3	3
Acetabular fracture	2	0
Femoral neck	0	1
Femoral shaft	2	3
Tibial plateau	0	4
Tibial shaft	2	4
Pilon fracture	2	1
Ankle fracture	2	2
Talus fracture	0	2

WB = weight-bearing, NWB = non–weight-bearing.
* Some patients sustained multiple lower extremity injuries.