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Original Article

Outcomes of patients with humerus fracture under treatment with PHILOS plate

Arsalan Mahmoodian[1], Pedram Yavari[1], Behrooz Fadaei[1], Sepehr Eslami[2], Mina Shakery Boroujeni[3], Ghasem Mohammadsharifi[1]

[1]Department of Orthopedics, School of Medicine, Isfahan University of Medical Sciences, Isfahan, Iran; [2]Department of Orthopedic Surgery, Abadan faculty of Medical Science, Abadan, Iran; [3]Department of Pathology, Abadan Faculty of Medical Science, Abadan, Iran

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Abstract: Background: Based on the contradictory results about the effect of an intramedullary nail in the treatment of humeral shaft fracture, in this study, we aim to evaluate the outcomes of patients with humeral fracture treated with PHILOS plaque. Methods: In this cross-sectional study, which was performed to evaluate the recovery rate of patients with humeral fracture treated with PHILOS plaque referred to Shahid Beheshti Hospital in Abadan-Iran during 2015-2019. Constant Shoulder Score was evaluated six months and one year after the operation. Results: The mean constant shoulder score was increased significantly after 1 year compared to 6 months ($P<0.001$). The means of constant shoulder score 6 months in type 4 of fracture was significantly higher than type 3 of fracture ($P=0.03$) but there was no significant relationship between the means of constant shoulder score 1 year after surgery and type of fracture. Conclusion: We suggest that orthopedic surgeons should pay more attention to the usage of PHILOS plate in patients with humerus fractures especially the type 4 fracture.

Keywords: Humeral, fracture, PHILOS, constant shoulder score

Introduction

Most humerus body fractures can be treated with a conservative approach with a success rate of more than 90% [1]. Indications for surgery of this fracture including; open fracture, vascular injury, progressive radial nerve injury, multiple injuries, bilateral fractures, association with upper limb fracture, burn injury, obese patients, transverse, segmental and spiral fractures, pathological fractures, spinal cord or brachial plexus injuries, and inability to create and maintain acceptable placement, so different types of fixation devices are used to treat these fractures [2]. Recently, using the intramedullary and interlock nails and screws and pressure plates are two common methods to fix fractures. In the theoretical fixation of the open fracture with using intramedullary nailing is a choice treatment method due to less invasiveness and the advantage of a biomechanical position, especially in osteopenia bone, and the production of autographs in rhyming [3, 4]. Although numerous reports and comparative studies have contradictory results, there is a growing interest in the use of intramedullary nail in the treatment of humerus shaft fractures due to the biomechanical and biological benefits of this method along with recent technical advances in the placement of this device [5].

Intramedullary nails have advantages such as less soft tissue damage and less radial nerve damage, but in the case of the non-locking nail, there are side effects such as poor rotational stability and sliding nail that cause problems for the joint [6, 7]. In cases where - lockable nails which have better clinical results in some articles, use a better rotational stability process and can prevent the nail from slipping. However, these cases have not yet been fully established [8, 9].

Although most cases of humeral shaft fractures are treated conservatively and with a high success rate, there is an increasing tendency for surgical treatment and this tendency has led to increased indications for surgery [2, 3, 5]. In surgical cases, fixation with the first choice plate of some surgeons is still due to acceptable performance and high welding percentage [6].

Comparative studies between plate fixation and intramedullary nails have conflicting results [7]. However, plate fixation is associated with a

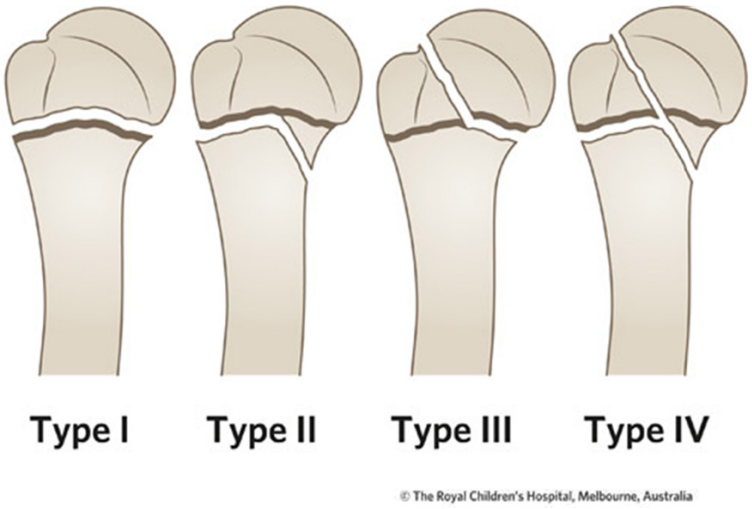

Figure 1. Humerus fracture types [22].

higher risk of iatrogenic nerve damage, longer operating time, increased need for intraoperative blood transfusions, and possibly an increased incidence of infection. Theoretical benefits such as minimal soft tissue trauma, prevention of fracture hematoma, and biomechanical advantages in the use of locking nails have made them increasingly common among surgeons in the treatment of humerus fractures. It also allows faster movement, which is important in cases of multiple injuries [10-12]. As spoken, there are controversial and contradictory results about the effect of an intramedullary nail in the treatment of humeral shaft fracture. These results could also vary in different populations. As a result, we aimed to evaluate the outcomes of patients with humeral fracture treated with PHILOS plaque. This is the first study in this field in Abadan city.

Methods and materials

Study design

In this cross-sectional study, we aimed to evaluate the recovery rate of patients with humeral fracture treated with PHILOS plaque referred to Shahid Beheshti Hospital in Abadan-Iran during 2015-2019. The study protocol was approved by the Research Committee of Abadan University of Medical Sciences and the Ethics committee has confirmed it.

Inclusion and exclusion criteria

Retrospectively, the patients operated in Al-Zahra Hospital were evaluated in the above years who met the inclusion criteria. Inclusion criteria were: patients with humerus fractures who underwent surgery with PHILOS plaque, age range over 18 years and signing the written informed consent to participate in the study. The exclusion criterion was incomplete patient information.

Data gathering

The data were collected in such a way that the physician who performed the surgeries. Available information was included age, gender, duration of surgery, typing of the humerus fracture (**Figure 1**), and the Constant Shoulder Score, which was evaluated 6 months and one year after surgery. Constant Shoulder Score consists of two parts that were filled by the physician and the patient. In this study, the part that was filled in and examined by the physician, the items that were examined included pain (15 points), daily activity (20 points), movement (40 points) and power (25 points).

Statistical analysis

Data were entered into SPSS statistical software version 18 (SW Statistics for Windows, Chicago: SPSS, Inc.). Quantitative data were shown as mean and standard deviation and qualitative data as frequency and percentage. Paired tests were used to compare quantitative data changes and, if necessary, chi-square and independent t-tests were used. P less than 0.05 was considered as a significant level.

Results

Population

In this study 33 patients including 22 male and 11 female with a mean age of 43.42 years were enrolled, the most common fracture was type 4 (68.8%) (**Table 1**).

Shoulder score

The means of constant shoulder score 6 months and 1 year after surgery were 75.54± 8.80 and 89.70±5.33, so the mean of constant shoulder score was increased significantly after

Table 1. Demographic variables of study

Variables		Mean	SD
Age (years)		43.42	10.94
		Frequency	Percent
Gender	Male	22	66.7%
	Female	11	33.3%
Type of fractures	3	10	31.3%
	4	22	68.8%

1 year compared to 6 months (P<0.001) (**Table 2**).

Further variables

There was no significant relationship between gender with the means of constant shoulder score 6 months (P=0.39) and 1 year (P=0.73) after surgery and also there was no significant correlation between age with the means of constant shoulder score 6 months (P=0.72) and 1 year after surgery (P=0.23). The means of constant shoulder score 6 months in type 4 of fracture was significantly higher than the type 3 of fracture (P=0.03) but there was no significant relationship between the means of constant shoulder score 1 year after surgery and type of fracture (**Table 3**).

Discussion

Here in the present study, we evaluated 33 patients with humerus fractures who had been treated with PHILOS plate. Our data indicated that the mean of constant shoulder score was increased significantly after 1 year compared to 6 months after interventions showing a better outcome. We also showed that the means of constant shoulder score 6 months in type 4 fracture was significantly higher than the type 3 of fracture. These data suggest that treatment with PHILOS plate is a beneficial technique in patients with humerus fractures especially the type 4 of fracture. There have been also some previous data on this matter.

In a study by Koukakis and colleagues, 20 patients with humerus fractures who had been treated by PHILOS plate were evaluated. They showed that the PHILOS plate overcomes most of the main hardware problems such as early failure and impingement syndrome. Furthermore, they declared that using the PHILOS plate is suitable for two-part, three-part, and

Table 2. The means of constant shoulder score 6 months and 1 year after surgery

Constant Shoulder Score (mean ± SD)		*P*-value*
Six months after surgery	One year after surgery	
75.54±8.80	89.70±5.33	0.001>

*Paired samples test.

certain patterns of four-part fractures in young and elderly patients [13]. Another study was conducted by Charalambous and colleagues in 2007 on 25 cases of humerus fractures. This study also showed that usage of the PHILOS plate could provide fracture stabilization and is an effective method [14]. Moonot and others also showed that three- and four-part fractures of the proximal humerus could be successfully treated with a PHILOS plate which has fewer complications compared to other techniques [15]. These results are in line with the findings of our study emphasizing the importance of PHILOS plate in humerus fractures.

Another study was performed by Rancan and others in 2010 on 29 patients with metadiaphyseal fractures of the proximal humerus. They showed that using the PHILOS plate is an effective method for treatments of patients however, some complications could exist [16]. Papadopoulos and others also evaluated 29 patients and showed successful results within 6 weeks after implantation of the PHILOS plate [17]. A key point of our study is that we followed the patients for 1 year and therefore, we believe that our results are more reliable than previous studies. Spross and others also conducted a study on the effectiveness of the PHILOS plate for humerus fractures. They showed that using the PHILOS plate brings acceptable functions for patients and suggested that more studies should be performed in this regard [18]. Comparing our results with previous studies, using PHILOS plate in type 4 humerus fractures are beneficial and associated with profitable and proper clinical outcomes.

The beneficial results of PHILOS plate usage for patients with humerus fractures were also indicated in a study by Erasmo and colleagues. They investigated 81 patients with 82 proximal humerus fractures and showed that the Constant-Murley score increased within the study duration. avascular necrosis of the

Table 3. The means of constant shoulder score 6 months and 1 year after surgery based on gender and type of fracture

Constant Shoulder Score		Six months after surgery	One year after surgery
Gender	Male	81.23±3.22	85.91±2.82
	Female	75.12±7.48	78.32±5.24
P-value*		0.39	0.73
Type of fracture	3	73.40±5.37	86.50±4.84
	4	79.58±7.82	79.58±7.82
P-value*		0.03	0.11

*Independent T test.

humeral head (12%), varus positioning of the head (4.8%), impingement syndrome (3.6%), secondary screw perforation (3.6%), non-union of the (2.4%) and infection (1.2%) were reported as the main complications in patients. they also suggested that to better evaluate the real incidence of complications, it is important to follow patients for more than one year after surgery as some complications may arise after this time [19]. These results are somehow in line with our findings. we also showed that PHILOS plate usage is an effective and beneficial method for patients with humerus fractures but we observed no significant complications in patients. As Erasmo and others suggested, most of these complications may arise after 1-year follow-up. These results have also been addressed before [20, 21]. We believe that more studies are required in this regard.

Conclusion

Taken together, we suggest that orthopedic surgeons should pay more attention to the usage of PHILOS plate in patients with humerus fractures especially the type 4 of fracture. However, more results with a longer follow-up duration about the complications of this method seem to be required.

Disclosure of conflict of interest

None.

Address correspondence to: Ghasem Mohammadsharifi, Department of Orthopedics, School of Medicine, Isfahan University of Medical Sciences, Hezar Jarib Blvd. Isfahan City, Isfahan Province, Iran. Tel: +989133236863; E-mail: mohammadsharifi.ghasem@gmail.com

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