Section A -Research paper

FUNCTIONAL OUTCOME OF SHAFT HUMERUS FRACTURE TREATED WITH ANTERIOR BRIDGE PLATING

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ABSTRACT
Background: To evaluate the functional prognosis of shaft humerus fractures treated with Anterior Bridge plating utilising the DASH Scoring System after the fractures had healed.
Methods: Thirty-three patients fulfilling inclusion criteria were treated with ABP at a level-I trauma centre using a 4.5-mm dynamic/locking compression plate and followed for a period of 1 year. Functional outcome was assessed using the Constant, Mayo elbow, and Disabilities of the Arm, Shoulder and Hand (DASH) scores. Range of motion (ROM), subjective strength, and radiographic union were assessed.
Results: Transverse fractures were found in 11 (33.3%), 13, (39.4%), 4 (12.1%), and 5 (15.2%) of the patients. The average procedure lasted 28.33±1.947 minutes; it was discovered. There were no cases of radial nerve palsy, 3 (9.1%) cases of delayed union, 2 (6.1%) cases of superficial infection, 2 (6.1%) cases of minimal shoulder movement restriction, 1 (3.0%) cases of decreased elbow movement, and 3 (9.1%) cases of shoulder pain when performing heavy manual labour. The average DASH score was found to be 10.48 ±1.108 at 6 months following surgery, and 13.66 0.983 at 3 months.
Conclusions: Anterior bridge plating is an innovative therapeutic approach for shaft humerus fractures, as demonstrated by the results of our research and taking into consideration the constraints of the study. This kind of therapy provides biological fixation with high rates of union and great functional outcomes, as determined by DASH scores, without creating any issues to the neurological system. In order to verify the findings, it is recommended that more study be carried out with a substantial number of participants over a longer period of time.
Keywords: Humeral fractures, Anterior bridge plating, minimally invasive surgery

INTRODUCTION

According to Denard Jr. (2010), the humerus is the most adaptable bone in the human body because it can be properly managed using a variety of fracture healing treatments. This makes the humerus the most adaptable bone in the human body. The functional bracing, plating (posterior, lateral, and anterior), and intramedullary nailing (antegrade and retrograde) are the therapies that fall under this category. Either the time-honored open technique or the less invasive minimally invasive procedures can be utilised to successfully complete the plating operation.

About three percent of all broken bones are caused by damage to the humeral shaft. According to Zhao (2017), humeral shaft fractures that only have a little amount of displacement are good candidates for conservative therapy. Splints, plating, and intramedullary riveting are only some of the many various therapy methods that have been described in the medical literature. There are also many other treatment mechanisms. According to Zhao (2017) and Lee (2012), each of these different treatment approaches has a number of advantages over the others.

There is a broad variety of acceptable reduction methods, which enables the efficient treatment of a significant percentage of humeral fractures with conservative care. This is possible since the humerus is a long bone. It is vital to customise these treatment options based on the features of the patient, as stated by Mahajan (2016), when there is a large variety of treatment options accessible. This is because the qualities of the patient are unique.

When it comes to treating shaft injuries, the use of conservative therapy is still regarded to be the treatment of choice. humerus fractures, despite the fact that it might result in unfavourable outcomes like as non-union and shoulder pain. According to Guru., 2015, one-twelfth of patients receiving conservative therapy had consolidation with more than 10 degrees of displacement, and one-fourth of patients have a restricted shoulder range of motion.

According to Chen (2013), patients who have had neurovascular injuries, injury to the brachial plexus, complicated fractures, polytrauma, floating elbow, or inadequate reductions are candidates for surgical treatment. Fractures of the Arbeitsgemeinschaft für Osteosynthesefragen (AO) - Orthopaedic Trauma Association (OTA) type, proximal third shaft oblique fractures, and distal third shaft fractures are examples of indications for surgical treatment of shaft humerus fractures. Fractures of the proximal third shaft are seen more frequently than fractures of the distal third shaft. Open reduction and internal fixation with a Dynamic compression plate, locking compression plate, intramedulary nail, and minimally invasive bridge plate are the recommended treatments for humeral shaft fractures, as stated by Pidhorz., 2015 and Kumar., 2013.

The most recent addition to this list is a procedure called anterior bridge plating (ABP), which is also known as minimally invasive percutaneous plate osteosynthesis (MIPPO). MIPPO is an abbreviation that describes a strategy that takes a non- or minimally intrusive approach to a problem and is widely known for its popularity. An anterior bridge plating treatment involves making two tiny incisions, one proximal and one distal to the area of the fracture. These incisions are done in order to plate the fracture. Anterior Bridge Plating, often referred to as MIPPO, is a procedure that utilises the minimally invasive approach known as Minimally Invasive Percutaneous Plate Osteosynthesis (MIPPO). This technique is also

referred to as MIPPO. When it comes to the treatment of humeral shaft fractures, this is now one of the most cutting-edge treatments that may be used. When traditional plating was employed, the fracture site needed to be opened and then it needed to be mended. However, overhead activities needed to be limited since the entrance via the rotator cuff needed to be secured (Zhao., 2017).

The anterior shoulder stabilisation method (ABP), which offers distinct advantages over the other two procedures due to the fact that it is minimally invasive, does not result in damage to the rotator cuff, and does not need opening the site of the fracture, is the preferred option. In addition to this, there is a decreased requirement for treatment with radiation, a shorter amount of time spent in surgery, and a less amount of blood loss. The application of ABP is known to result in functional outcomes that are superior to those that may be reached via the application of other methods. The Disability of Arm, Shoulder, and Hand (DASH) questionnaire is used here for the aim of determining functional outcomes.

The Disability of Arm, Shoulder, and Hand (DASH) questionnaire was developed by the American Academy of Orthopaedic Surgeons in order to serve as a subjective upper extremity outcome measure. The fact that the upper extremity functions as a unit is the argument that has garnered the most broad attention for the use of a single outcome measure for a range of upper extremity impairments. This recognition has occurred as a result of the fact that the upper extremity is able to operate together. Due to the fact that the present research is focused on functional result, it is plausible to assume that the DASH score has the potential to measure impairment (Qiu., 2016, Wang., 2015).

A recent search of the relevant literature unearthed a considerable number of publications that examine this topic through the lens of a variety of distinct case studies. There are no studies that have been done, as far as we are aware, that specifically analyse fractures of the mid-shaft of the humerus in overhead athletes or manual workers.

However, there are some concerns regarding the biological disruption of soft tissue, poor aesthetic scarring, and direct manipulation of the radial nerve that are associated with the typical open posterior plating procedure. Although this procedure is safe for the rotator cuff, it does have some drawbacks. The rotator cuff can be treated with the time-honored technique of open posterior plating, which is a procedure that is risk-free. On the other side, intramedullary stapling is a method that is less intrusive; nonetheless, it has the danger of causing damage to the rotator cuff in addition to impingement of the shoulder. The ABP was developed with the intention of combining the aspects of these two procedures that are seen as having the most positive effects. As a consequence, the ABP is a procedure that is minimally invasive, helpful to the patient's cosmetic appearance, and results in the least amount of alteration to the body's vital structures. (Wang., 2015).

In light of this, the purpose of the current study was to investigate the functional prognosis of shaft humerus fractures that had been treated with anterior bridge plating employing the DASH Scoring System after the fractures had healed.

MATERIALS AND METHODOLOGY

A prospective observational study in which 33 patients were chosen at random, all of whom satisfied the criteria for inclusion and had anterior bridge plating for shaft surgery done. The

orthodontic department at the Krishna Institute of Medical Sciences in Karad, Maharashtra served as the location for the research project's execution.

The data collection phase spanned from December 2017 to December 2018. After the process of collecting data was finished, the data entry forms went through a process of verification to ensure that they contained all of the necessary information. After that, the patient profile that corresponded was evaluated against the data to see whether it had any gaps or unintelligible information. Utilising a spreadsheet was necessary in order to complete the process of data entry. The technique described above was carried out continuously throughout the course of a period of two months (60 days). One month was devoted to the activities of data recovery and data purification, both of which were carried out in succession. The data that was acquired went through an analytical process that lasted for a period of three months, and the writing of the report was finished by the end of October in the year 2019.

The following is a list of the conditions that must be met in order to be included: The following are the criteria that were used to include participants in the study: (1) fractures that are located in the middle of the shaft of the humerus; (2) persons with jobs that largely entail overhead activities such as athletes, throwers, and labourers; (3) individuals who have attained skeletal maturity; and (4) a minimum follow-up duration of one year at the time the study was being conducted.

The following is a list of the requirements that must be met in order to be in excluded criteria: This study excluded participants who had any substantial injuries or damage to the ipsilateral upper limb or neurovascular system, as well as any other injuries that were deemed to be significant enough to possibly impede patient recovery. People who had a history of old humeral fractures, people who were skeletally immature, and people who had systemic diseases that severely affected the bone, primary bone disease, or cancer anywhere in the body were also excluded from the study. Last but not least, those who had open fractures were not allowed to participate in the research.

Research Material Sources

A semi-structured questionnaire that had been predesigned was produced following the completion of a literature search on shaft humerus fractures that were treated with anterior bridge plating. The information that was requested for the questionnaire included the respondent's age, gender, the side of the arm that was broken, the kind of fracture, the degree of fracture, the cause of injury, concurrent injuries, co-morbidities, the result, and complications. Additionally, the information requested included the results. Patients were monitored for a period of one year, during which time they had serial radiographs and clinical assessments at six weeks, three months, and one year after surgery. In order to carry out the process of doing the analysis of the data, the Disabilities of the Arm, Shoulder, and Hand (DASH) score technique was applied.

DASH Questionnaire

The Disabilities of the Arm, Shoulder, and Hand (DASH) outcome measure is a self-report questionnaire that consists of 30 questions and is aimed to evaluate a patient's general health during the seven days before to the assessment. The questionnaire is designed to evaluate the patient's condition during the time period immediately preceding the examination. The items ask about the degree of difficulty in performing various physical activities because of

problems with the arm, shoulder, and hand (there are a total of 21 items), the severity of each of the symptoms of pain, activity-related pain, tingling, weakness, and stiffness (there are a total of five items), and the impact of the problem on social functioning, work, sleep, and self-image (there are a total of four items) (Wang., 2015).

In particular, the items inquire about the degree of difficulty involved in doing a variety of various physical tasks as a result of difficulties with the arm, shoulder, and hand. There are five different responses that might be given to each question. The findings are then used to generate a scale score known as the DASH score. This score can vary from 0 (no impairment) to 100 (the most severe disability), with 0 representing no impairment and 100 representing the most severe disability. The DASH questionnaire is an indicator that may be used to identify how the impact of an impairment corresponds to the degree of disability as well as the kind of impairment. In order to measure how effectively a person is able to function, this assessment takes into account the individual as a whole and takes into account their ability to compensate with their other limb.

Materials used -

4.5mm Narrow Dynamic Compression Plates, 4.5mm Cortical screws of varying lengths, Hexagonal screw driver, 3.2 mm drill bit, Depth gauge, C- arm

Figure 1: Instruments

Surgery and Recovery

Following the pre-anesthetic examination, the patient was either given a local brachial block or put under general anaesthesia. In addition to painting and draping, sterile cleaning is also performed. Patients were placed in the supine position for the procedure, and fluoroscopic monitoring was used during the procedure. The submuscular, extra periosteal anterior humeral bridge plating was performed. After determining the appropriate length for the plate, it is then put across the front of the arm and checked using a C-arm picture. The Dynamic Compression plate that is utilised typically has a length of 12 holes and a width of 4.5 mm.

Throughout the process, the shoulder was abducted at an angle of 30–60 degrees, the elbow was flexed to an angle of approximately 90 degrees, and the forearm was supinated. The use of indirect reduction was chosen because it provided good fracture reduction.

The proximal incision was approximately 2–3 centimetres long and was made as proximal as feasible in this intermuscular plane. This incision was made between the deltoid and the

proximal region of the biceps. The distal incision, which was of a similar length, was made as distal as feasible while still ensuring that the plate stopped proximal to the supracondylar area. Additionally, the brachialis was divided in order to access the anterior surface of the humerus. The radial nerve was protected by the lateral split brachialis muscle, and the medial retraction of the biceps allowed the neurovascular bundle to be brought closer to the arm. The neuropraxia was able to avoid an excessive amount of retraction.

According to Wang et al., an acceptable amount of fracture end migration is 15 degrees of angulation in either plane and 1 centimetre overall, and anything beyond that requires a second reduction attempt. According to Krettek et al., the cortical step sign and the diameter difference sign decreased the amount of malrotation that occurred during fixation.

The 4.5-mm DCP/LCP that was determined to be the longest based on humeral anatomy was selected. When inserting the anterior distal screws, the brachial artery, the musculocutaneous nerve, and the radial nerve were all taken into consideration. 12,17-20) All of the cases used simple cortical screws (two proximally and two distally), with the exception of those in which locking screws were used because the bone was highly osteoporotic.

Figure 2: Verifying the

Figure 3: Marking the

Figure 4: Position of Arm

Figure 5: Incision

In order to locate the musculocutaneous nerve that lies on top of the brachialis muscle, a retraction of the biceps brachi is performed. Following this, the nerve is retracted. After that, the brachialis muscle is divided until bone is reached. The brachialis muscle serves as a barrier to prevent injury to the radial nerve. Following the creation of an additional periosteal tunnel below the brachialis muscle, a 4.5mm Non-Locking Dynamic Compression Plate is then moved via the proximal incision.

Figure 6. Insertion of Plate

Figure 7. Verification of Reduction Under Fluoroscopy

Traction, counter-traction, and manipulation are the three techniques that are used to restore the varus/valgus angulation of the elbow, the length of the arm, and rotation. C-arm imaging is used to confirm that the fracture has been reduced. The rotation of the C-arm machine, and not the humerus bone itself, is what does the imaging. Two screws oriented in an anterior-posterior orientation are used to secure either end of the plate.

A distal hole is bored out of the two holes that are located closest to the proximal end using a drill bit measuring 3.2 millimetres, and then a unicortical screw is inserted. After the first screw has been inserted, the second screw is inserted into the hole that is the second-to-last one. After ensuring that the plate is properly positioned and that the fracture has been reduced, both screws are then tightened in order to achieve bicortical purchase. Holes are bored at the far ends, and bicortical screws of the proper length are put in those holes.The wound is stitched up in stages or layers.

Figure 8: Position of Distal Screws

Figure 9: Skin Closure

Post operative protocol

Antibiotics were administered intravenously to the patients for a total of three days. Patients were provided with shoulder pouches following surgical procedures. On day one after surgery, patients were instructed to begin range of motion exercises for their shoulder and elbow joints.

Exercises including the shoulder pendulum, aided and active forward elevation of the shoulder, assisted and active abduction and extension of the shoulder, and flexion and extension of the elbow were gradually introduced.

After a successful clinical and radiological union had been achieved and the patient's tolerance had been determined, the patient began a gradual programme of weight lifting six weeks after their operation.

The DASH score was calculated at three months and six months to determine the patient's functional outcome.

Assessment Criteria

In order to evaluate radiological union, post-operative radiographs were obtained at three and six months following the surgery.

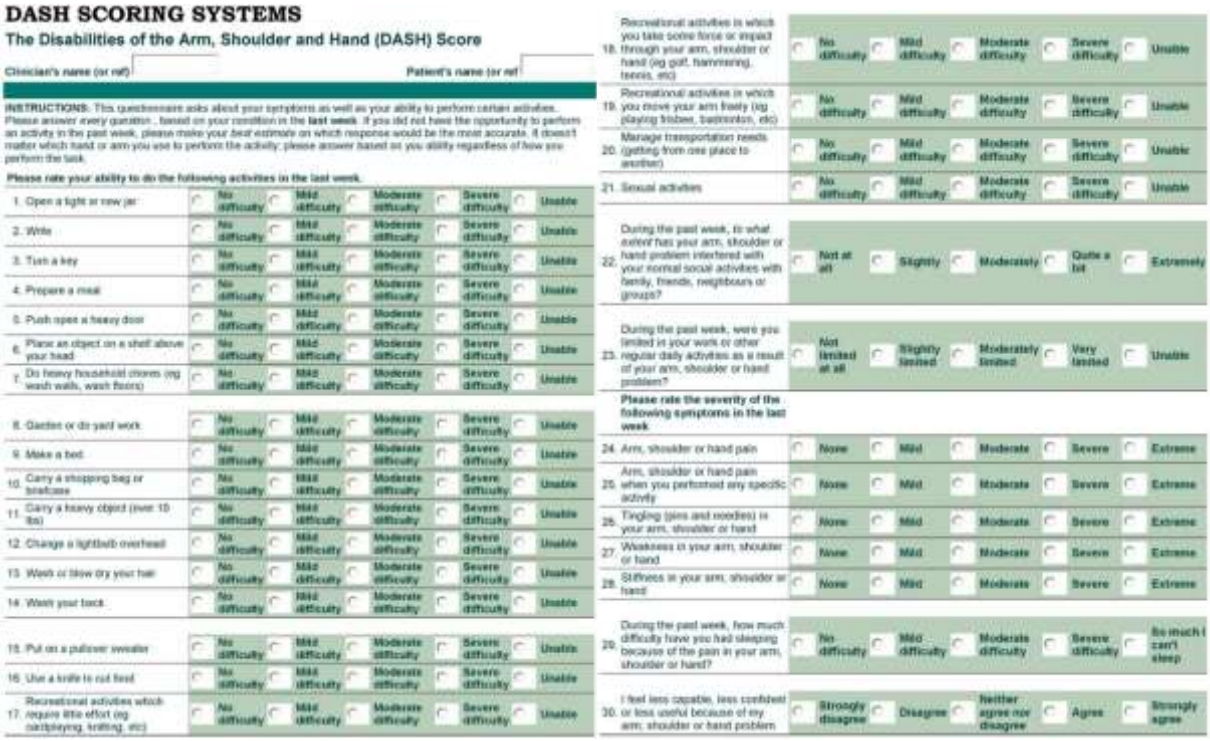
The Telltale Marks of the Radiological Union

1) Soft tissue swelling
2) Periosteal reaction
3) Soft Callus
4) Hard callus
5) Bridging Callus for 3 cortices in 2 views of radiographs
6) Remodelling

Clinical Signs of Union

1) Absence of Pain at fracture site
2) Absence of Tenderness over fracture site

Patients who showed evidence of union after three months have been classified as having "Delayed Union," a term that describes this condition.



DASH SCORING SYSTEMS

The Disabilities of the Arm, Shoulder and Hand (DASH) Score

Clinician's name (or ref) Patient's name (or ref)

INSTRUCTIONS: This questionnaire asks about your symptoms as well as your ability to perform certain activities. Please answer every question , based on your condition in the **last week**. If you did not have the opportunity to perform an activity in the past week, please make your *best estimate* on which response would be the most accurate. It doesn't matter which hand or arm you use to perform the activity; please answer based on you ability regardless of how you perform the task.

Please rate your ability to do the following activities in the last week.

1. Open a tight or new jar	No difficulty	Mild difficulty	Moderate difficulty	Severe difficulty	Unable	
2. Write	No difficulty	Mild difficulty	Moderate difficulty	Severe difficulty	Unable	
3. Turn a key	No difficulty	Mild difficulty	Moderate difficulty	Severe difficulty	Unable	
4. Prepare a meal	No difficulty	Mild difficulty	Moderate difficulty	Severe difficulty	Unable	
5. Push open a heavy door	No difficulty	Mild difficulty	Moderate difficulty	Severe difficulty	Unable	
6. Place an object on a shelf above your head	No difficulty	Mild difficulty	Moderate difficulty	Severe difficulty	Unable	
7. Do heavy household chores (eg wash walls, wash floors)	No difficulty	Mild difficulty	Moderate difficulty	Severe difficulty	Unable	
8. Garden or do yard work	No difficulty	Mild difficulty	Moderate difficulty	Severe difficulty	Unable	
9. Make a bed	No difficulty	Mild difficulty	Moderate difficulty	Severe difficulty	Unable	
10. Carry a shopping bag or briefcase	No difficulty	Mild difficulty	Moderate difficulty	Severe difficulty	Unable	
11. Carry a heavy object (over 10 lbs)	No difficulty	Mild difficulty	Moderate difficulty	Severe difficulty	Unable	
12. Change a lightbulb overhead	No difficulty	Mild difficulty	Moderate difficulty	Severe difficulty	Unable	
13. Wash or blow dry your hair	No difficulty	Mild difficulty	Moderate difficulty	Severe difficulty	Unable	
14. Wash your back	No difficulty	Mild difficulty	Moderate difficulty	Severe difficulty	Unable	
15. Put on a pullover sweater	No difficulty	Mild difficulty	Moderate difficulty	Severe difficulty	Unable	
16. Use a knife to cut food	No difficulty	Mild difficulty	Moderate difficulty	Severe difficulty	Unable	
17. Recreational activities which require little effort (eg cardplaying, knitting, etc)	No difficulty	Mild difficulty	Moderate difficulty	Severe difficulty	Unable	
18. Recreational activities in which you take some force or impact through your arm, shoulder or hand (eg golf, hammering, tennis, etc)	No difficulty	Mild difficulty	Moderate difficulty	Severe difficulty	Unable	
19. Recreational activities in which you move your arm freely (eg playing frisbee, badminton, etc)	No difficulty	Mild difficulty	Moderate difficulty	Severe difficulty	Unable	
20. Manage transportation needs (getting from one place to another)	No difficulty	Mild difficulty	Moderate difficulty	Severe difficulty	Unable	
21. Sexual activities	No difficulty	Mild difficulty	Moderate difficulty	Severe difficulty	Unable	
22. During the past week, to what *extent* has your arm, shoulder or hand problem interfered with your normal social activities with family, friends, neighbours or groups?	Not at all	Slightly	Moderately	Quite a bit	Extremely	
23. During the past week, were you limited in your work or other regular daily activities as a result of your arm, shoulder or hand problem?	Not limited at all	Slightly limited	Moderately limited	Very limited	Unable	
Please rate the severity of the following symptoms in the last week.						
24. Arm, shoulder or hand pain	None	Mild	Moderate	Severe	Extreme	
25. Arm, shoulder or hand pain when you performed any specific activity	None	Mild	Moderate	Severe	Extreme	
26. Tingling (pins and needles) in your arm, shoulder or hand	None	Mild	Moderate	Severe	Extreme	
27. Weakness in your arm, shoulder or hand	None	Mild	Moderate	Severe	Extreme	
28. Stiffness in your arm, shoulder or hand	None	Mild	Moderate	Severe	Extreme	
29. During the past week, how much difficulty have you had sleeping because of the pain in your arm, shoulder or hand?	No difficulty	Mild difficulty	Moderate difficulty	Severe difficulty	So much I can't sleep	
30. I feel less capable, less confident or less useful because of my arm, shoulder or hand problem	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	

Ethical Issues

The university's Scientific and Ethical Committee reviewed and gave its clearance to the study protocol before it could move forward. In addition, each participant was briefed about the process that would be followed during the research as well as the information that was expected of them. The participants in the study gave their free and informed written agreement, and only those participants who gave their consent were included in the research. Both the personal information of the participants and the information that was relevant to the study were treated with the utmost discretion at all times.

Statistical Analysis

Microsoft Excel and the Epi-info software were utilised in the process of managing and analysing the data. Both the frequency distribution and the graph pertaining to the variables were created. The Pearson chi-square test was utilised in order to analyse the category variables. In order for the results of the test to be regarded as significant, the p value had to be lower than 0.05.

RESULTS

The demographic profile of the patients is tabulated in Table 1.

Age (in years)	**Frequency**	**Percent**
18 – 30	5	15.2
31 – 40	12	36.4
41 – 50	9	27.3

51 – 60	6	18.2
61 – 70	1	3.0
Total	33	100.0

The age breakdown of the cases is presented in the table just above. According to the observations, 5 (15.2%) of the cases were between the ages of 18 and 30, 12 (36.4%) of the cases were between the ages of 31 and 40 years, 9 (36.4%) of the cases were between the ages of 41 and 50 years, 6 (18.2%) of the cases were between the ages of 51 and 60 years, and 1 (3.0%) of the cases were between the ages of 61 and 70 years.
The patients had an average age of 37.81 years old, with a standard deviation of 12.12 years. Patients' ages ranged from 18 to 62 years old, with the youngest being 18 years, and the oldest being 62 years.

Table 2: Gender wise distribution of cases

Gender	**Frequency**	**Percent**
Male	24	72.7
Female	9	27.3
Total	33	100.0

The gender breakdown of the cases is presented in the table that can be seen above. The subjects of the study consisted of 24 males (72.7%), with just 9 (27.3%), participants being females.

Table 3: Distribution of cases according to affected Side

Affected Side	**Frequency**	**Percent**
Right	14	42.4
Left	19	57.6
Total	33	100.0

The above table shows distribution of cases according to affected side. It was seen that 14 (42.4%) cases were in right arm while 19 (57.6%) cases were in left arm.

Table 4: Distribution of cases according to type of fracture

Type of fracture	**Frequency**	**Percent**
Transverse	11	33.3

Comminuted fracture	13	39.4
Segmental	4	12.1
Oblique	5	15.2
Total	33	100.0

The breakdown of instances into different types of fractures is presented in the table that can be seen above. 11 (33.3%) of the cases were found to have a transverse fracture, 13 (39.4%) of the cases were found to have a transverse fracture, 4 (12.1%) of the cases were found to have a transverse fracture, and 5 (15.2%) of the cases were found to have a transverse fracture.

Table 5: Case distribution according to level of fracture

Level of fracture	**Frequency**	**Percent**
Upper third	4	12.1
Middle third	24	72.7
Lower third	5	15.2
Total	33	100.0

The distribution of cases according to level of fracture may be seen in the table that was just shown. It was discovered that four instances (12.1%) had a fracture in the top third, twenty-four cases (72.7%) had a fracture in the middle third, and five cases (15.2%) had a fracture in the bottom third.

Table 6: Distribution of cases according to Mode of Injury

Mode of Injury	**Frequency**	**Percent**
Road traffic Accident	16	48.5
Fall from height	9	27.3
Industrial accident	5	15.2
Direct trauma	3	9.1
Total	33	100.0

It was determined that 16 (48.5%) of the cases involved a road traffic accident, 9 (27.3%) involved a fall from height, 5 (15.2%) involved an industrial accident, and 3 (9.1%) involved direct trauma.

Table 7: Case distribution according to Co-morbidities

Co-morbidities	Frequency	Percent
Diabetes Mellitus	2	6.1
Hypertension	4	12.1
Asthma	1	3.0
No comorbidity	26	78.8
Total	33	100.0

The distribution of patients according to co-morbidities is displayed in the table that was just presented. It was found that 1 (3.0%) of the patients had asthma, 4 (12.1%) of the cases had hypertension, and 2 (6.1%) of the cases had diabetes mellitus. However, 26 (78.8%) of the cases did not have any co-morbidity.

Table 8: Case distribution according to associated injuries

Associated injuries	Frequency	Percentage
Head injury	2	6.1
Both forearm bone fracture	1	3.0

The distribution of cases according to accompanying injuries is displayed in the table that was just presented. It was found that two of the patients (6.1%) suffered brain injuries, while one of the cases (3.1%) had a fracture in both of the forearm bones.

Table 9: Distribution of cases according to surgery time

Variable	Mean ± SD	Min – Max
Mean surgery time (minutes)	28.33 ± 1.947	25.0 – 32.0

The distribution of instances in relation to the amount of time spent operating is presented in the table above. It was found that the average duration of operation was 28.33 minutes, with a standard deviation of 1.947 minutes.

Table 10: Distribution of cases according to radiological union (weeks)

Variable	Mean ± SD	Min - Max
Mean radiological union	11.20 ± 1.530	9.0 – 15.0

The distribution of instances in accordance with radiological union is displayed in the table above. Radiological union was seen to take a mean of 11.20 1.530 weeks (ranging from a minimum of 9.0 weeks to a maximum of 15.0 weeks).

Table 11: Distribution of cases according to Outcome

Outcome	Frequency	Percent
Union	30	90.9
Delayed union	3	9.1
Non union	0	0
Total	33	100.0

The table that can be found above displays the breakdown of cases based on their outcomes. It was found that 30 (90.9%) of the cases had union, 3 (9.1%) of the cases had delayed union, and there were no instances that did not have union.

Table 12: Case distribution according to Complications

Complications	Frequency	Percent
Non union	0	0
Delayed union	3	9.1
Superficial infection	2	6.1
Radial nerve palsy	0	0

There were no occurrences of radial nerve palsy or non-union, however it was noticed that three (9.1%) of the patients had delayed union and two (6.1%) of the cases had superficial infections.

Table 13: Distribution of cases according to DASH Score

Score range	Mean ± SD	Min - Max
3 months	13.66 ± 0.983	12.5 – 15.0
6 months	10.48 ± 1.108	9.2 – 11.7

The table that can be found above displays the distribution of instances in accordance with the DASH score. At three months following surgery, the observed mean DASH score was 13.66 with a standard deviation of 0.983, and at six months after surgery, the score was 10.48 with a standard deviation of 1.108.

DISCUSSION

The most significant discovery made by our research was the fact that AP can be a viable treatment for mid-shaft humeral fractures in patients who were largely involved in occupations that required them to perform overhead motions, resulting in outstanding functional and radiological results. The functional outcome that was attained in our study is equivalent to that which was achieved in previous studies that were similar and focused on this issue.

Distribution of cases according to affected Side

In the current study, a fracture was detected in the right arm in 14 (42,4%) of the cases, whereas a fracture was observed in the left arm in 19 (57.6%) of the cases.

According to the findings of the research carried out by Abhishek S. Mahajan and colleagues, fractures were found in the dominant arm in 36 instances (68.8%), whereas fractures were found in the non-dominant arm in 15 cases (31.3%).

In the research carried out by Mohammed Ibrahim and colleagues, a fracture was found in the dominant arm in seven out of ten instances (70%) while a fracture was found in the non-dominant arm in three out of ten cases (30%).

Distribution of cases according to level of fracture

According to the findings of this study, there were 4 instances (12.1%) that had a fracture in the top third, 24 cases (72.7%) that had a fracture in the middle third, and 5 cases (15.2%) that had a fracture in the bottom third.

In the research carried out by Malleswara Rao Perumalla Venkata Naga et al., it was discovered that 2 instances (7.14%) had fractures in the top third, 17 cases (60.72%) had fractures in the middle third, and 5 cases (17.86%) had fractures in the bottom third.

Distribution of Cases Based on Different Types of Injuries

According to the findings of this study, 16 (48.5%) of the cases involved a road traffic accident, 9 (27.3%) of the cases involved a fall from a height, 5 (15.2%) of the cases involved an industrial accident, and 9 (27.3%) of the cases involved direct trauma.

According to the findings of the research carried out by Abhishek S. Mahajan and colleagues, 25 (52.1%) of the instances involved a road traffic accident, 13 (27.1%) of the cases involved a fall from height, and 10 (20.8%) of the cases involved a direct blow or attack.
According to the findings of the research carried out by Shetty MS et al., 81.2% of the cases included a road traffic accident, 12.5% of the cases involved a fall from a height, and 6.3% of the cases involved a direct blow or attack.

Distribution of cases in accordance with the amount of time spent in surgery

The current investigation revealed that the average duration of an operation was 28.33 minutes, with a standard deviation of 1.947 minutes.
According to the research that was carried out by Abhishek S. Mahajan and colleagues, the average amount of time spent in surgery was 95.5 minutes (the range was 75 to 132 minutes).
According to the research carried out by Mohammed Ibrahim and colleagues, the average amount of time spent in surgery was eighty minutes (the range was sixty to one hundred minutes).
According to the research that was carried out by Abhishek S. Mahajan and colleagues, the average amount of time spent in surgery was 95.5 minutes (the range was 75 to 132 minutes).

Case Distribution according to radiological union

The current study found that the mean radiological union was 11.20 weeks (ranging from a minimum of 9.0 weeks to a maximum of 15.0 weeks).
The research that was carried out by Mohammed Ibrahim and colleagues found that the average radiological time for fracture union was 11.6 weeks (range: 10–18 weeks).
According to the research that was carried out by Naga Raju Gude and colleagues, the amount of time it took for radiological union to occur ranged anywhere from 8 to 34 weeks on average.

Distribution of cases according to Outcome

During the course of this research, it was found that 30 (90.9%) of the instances had union, 3 (9.1%) of the cases had delayed union, and none of the cases had non-union.
In the research carried out by Abhishek S. Mahajan and colleagues, it was found that 45 of the instances (93.7%) had union, whereas two of the cases (4.17%) did not have union, and one of the cases (2.08%) had a loss of strength and tingling across the arm.
In the research carried out by Juan M. Concha et al., it was found that 31 of the instances had union, which accounts for 88.6% of the total, while 3 of the cases (8.5%) had non-union and 1 of the cases (2.8%) had mal-union.

Distribution of cases according to Outcome

In the current investigation, it was shown that three instances (9.1% of the total) had delayed union, two cases (6.1%) had superficial infection, and none of the patients had radial nerve palsy.
In the research carried out by Abhishek S. Mahajan and colleagues, it was found that two of the cases (4.17% of the total) had a superficial infection, two of the cases (6.1%) had minimal restriction of shoulder movement, two of the cases (4.17% of the total) had tingling over the forearm, and one of the cases (2.08% of the total) had a hypertrophic scar. However, none of the cases had a deep infection or a major neurovascular injury.

At the time of the final evaluation, 43 out of 45 patients (93.7%) had returned to their previous places of employment. Because of the discomfort, loss of strength, and sensation of tightness in the operated limb, the remaining three patients (6.25% of the total) needed to make adjustments to their previous jobs. Two of these patients experienced cases of non-union.

In the research carried out by Sushant Uday Chavan and colleagues, there was one case of postoperative radial nerve neuropraxia, but by the conclusion of the study period three months later, the patient had made a full recovery. In this particular research endeavour, neither a shallow nor a profound infection was found to have occurred. We did not find any incidences of non-union or malunion in our research.

Distribution of cases according to DASH Score

The current study found that the mean DASH score three months after surgery was 13.66 with a standard deviation of 0.983, and that the mean score six months after surgery was 10.48 with a standard deviation of 1.108.

According to the findings of the research carried out by Sushant Uday Chavan and colleagues, the average Disability of Arm, Shoulder, and Hand (DASH) score was 18.5 points at the conclusion of one year.

Patients who were treated with plating had an average DASH score of 24.654, whereas those who were treated with interlocking nailing had an average score of 37.168, according to the research carried out by Malleswara Rao Perumalla Venkata Naga et al. Both Sushant Uday Chavan et al. and Malleswara Rao Perumalla Venkata Naga et al. found a higher DASH score, which is most likely attributable to the distinct surgical techniques that were employed by each group.

There are certain shortcomings in our research. To begin, the study did not include a control group to which our findings could be compared, and the rate of follow-up was less than one hundred percent, both of which are potential sources of bias in the research. In spite of this, the primary objective of our research was not to evaluate the efficacy of ABP in comparison to other forms of treatment but rather to determine the value of ABP in a particular patient population. Second, an exact calculation of the malrotation of the humerus following union was not possible because postoperative computed tomography images were not performed.

CONCLUSION

According to the findings of our research, within the limitations of the study, anterior bridge plating is a unique treatment technique for shaft humerus fractures. This treatment modality offers biological fixation with high rates of union and excellent functional results, as measured by DASH scores, without causing any neurological problems. It is advised that more research be conducted with a large sample size and for a longer amount of time to confirm the results.

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