Annals of Surgery: International
Received: Jul 11, 2016, Accepted: Aug 09, 2016, Published: Aug 13, 2016
Ann Surg Int, Volume 2, Issue 6
http://crescopublications.org/pdf/asi/ASI-2-035.pdf
Article Number: ASI-2-035

Research Article Open Access

Clinical Outcome of Monteggia Fractures – A Median Observation Time of 12 Years

Manuela Jaindl[1], Andreas Wippel[1], Georg Endler[2] and Florian M. Kovar[1*]

[1]Department of Trauma Surgery, General Hospital Vienna, Medical University of Vienna, Waehringerguertel 18-20, 1090 Vienna, Austria
[2]Institute of Medical and Chemical Laboratory Diagnostics, General Hospital Vienna, Medical University Vienna, Waehringerguertel 18-20, 1090 Vienna, Austria

***Corresponding Author**: Florian M. Kovar, MD, Department of Trauma Surgery, General Hospital Vienna, Medical University of Vienna, WaehringerGuertel 18-20, A-1090 Vienna, Austria; Tel: +43 1 40400 59020; Fax: +43 1 40400 59490; E-mail: florian.kovar@meduniwien.ac.at

Citation: Manuela Jaindl, Andreas Wippel, Georg Endler and Florian M. Kovar (2016) Clinical Outcome of Monteggia Fractures – A Median Observation Time of 12 Years. Ann SurgInt 2: 035.

Abstract

Aim: Monteggia lesion is most precisely characterized as a forearm fracture in association with dislocation of the proximal radio ulnar joint. It is widely recognized by trauma surgeons, due to the poor results associated with the treatment of those injuries. Our purpose was to evaluate the results of surgical treatment in adult patients with those fractures.

Material and Methods: In a 10-year period, 16 non-selected trauma patients where included retrospectively. We collected data on all victims admitted to the hospital with diagnosed Monteggia injuries. Median long-term follow-up was 12 years (range, 5-15).

Results: The mean age was 53 years (range 23 to 81), 3 were males and 13 were females. Total median follow-up was 12 years (range, 5-15). Improvement of flexion and flexion-extension arc was statistical significant ($p<0.005$) in comparison between early and long-term follow-up. Results for extension deficit, and supination-rotation arc were trend wise.

Conclusion: Our results of surgical treatment in adult patients with Monteggia injuries showed improved outcome findings. Excellent rating according to Broberg and Morrey was achieved in 11 patients, good in 4 cases, and fair in one case after a median follow-up period of 12 years.

Keywords: Monteggia fracture; Adults; Surgery; Outcome.

Introduction

The Monteggia lesion has been well describedin the literature [1-3]. The classic paper written by Bado in 1962 coined the term "Monteggia Lesion" and can be seen as the cornerstone for understanding the complexity of the injury [3]. Fractures of the forearm with dislocation of the proximal radio ulnar joint are termed as "Monteggia" fractures [4-6]. The different Bado Types are mainly focusing on the direction of luxation of the radiocapitelar head.Bado classification reflects the fact that the radial head can displace anteriorly (type I), posteriorly (type II), or laterally (type III) and anterior radial head dislocation as well as proximal third ulnar and radial shaft fractures (type IV) [3].

Several authors made important contribution in understanding the mechanism of this injury [7,8], buteven after numerous studies, the pathogenesis remains controversial [9].Recognition of the importance of precise restoration of the length and alignment of the ulna lead to better results, due to improved congruence at the radio ulnar joint [5,6,10]. Neglecting this important factor and using inadequate implants in pre AO era, the standard now is a 3.5-mm DC (Dynamic Compression) or an LC-DCP (Locking Compression-Dynamic Compression Plate) plate in adults, was often leading to devastating results. [5,6,10-12].

To our knowledge, there is a lack of long-term results of Monteggia injuries treated with modern methods of internal fixation[11]. Also "a mix up of pediatric and adult cases, skeletally immature as borderline" - can be seen as critical, making it hard to compare previous studies with actual ones – conducted by different standards and more advanced surgical techniques [10-12].

We hypothesized that clinical outcome after surgical treatment was improved after a median time of 12 years. The purpose of this retrospective study was to evaluate the subjective and objective functional long-term outcome of Monteggia injuries in a skeletally mature study population.

Material and Methods

In a ten-year period, 16 non-selected trauma patients where included in our retrospective, IRB approved, study at a level I trauma center, Department of Trauma Surgery, Medical University of Vienna, Austria. We collected data on all patients admitted with diagnosed Monteggia lesions. An independent member of the Department not involved in the study performed a random crosscheck to exclude possible errors.

Between 2000-2010, 22 adult patients were diagnosed with Monteggia injuries according to Bado classification,based on radiographs taken immediately after injury[3].Ulnar diaphysis was defined as beginning distal to the distal margin of the coronoid process. A total of 6 patients had to be excluded: 3 patients died before a possible long term follow-up visit, and in 3 patients complete data were not achieved or were unavailable for long term follow-up.

Sixteen trauma patients met the inclusion criteria. The mean age was 53 years (range 23 to 81), 3 were males and 13 were females. Total median follow-up was 12 years (range, 5-15). In our study population a total of 5 fractures type I, 8 types II, 1 type III and 2types IV have been observed according to the Bado classification. 8 patients were diagnosed with an additional fracture of the radial head. All fractures were closed.All 16 cases were treated within 48 hours after injuryby an attending trauma surgeon, familiar with the AO principles and techniques of internal fixation [13].

Methods of Assessment

The rehabilitation protocol was identical for all patients. A postoperative cast was applied for 2 weeks, with the elbow in 90° angle. Rehabilitation program with passive motion started 2 weeks postoperatively. Physiotherapy including, passive joint mobilization and active mobilization after 4 weeks was recommended for 2 months. Lifting of heavy weight was generally permitted after 3 months.

Early follow-up evaluation was performed after a median of 2 years (range, 0-7) after surgery. Surgery was performed a median of 0 days (range, 0-2) after injury. Median age of the study population at final follow-up was 63 years (range, 28-89).

Early follow-up included: TTS (time to surgery), age, gender, TTFU (time to follow-up) from surgery, flexion and extension in the elbow joint, pronation and supination in the radio ulnar joint, and pain evaluation. Evaluation of x-rays related to, fracture healing, implant failure and alignment of the radiocapitelar head.

Long-term follow-up took place at a median of 12 years (range, 5-15) after injury. Long term follow-up included the following: age, gender, FU (time to follow-up from surgery), flexion and extension in the elbow joint, pronation and supination in the radio ulnar joint, and pain evaluation, the Broberg and Morrey Functional Rating Index (BM Score) [14], the DASH (Disabilities of the Arm, Shoulder, and Hand) score[15], Mayo Elbow Performance Index (MEPI) [16].Range of motion was measured using a hand-held goniometer, by physician on duty at early follow-up, and by the same person at all Long-term follow-ups. Varus and valgus laxity was evaluated in full extension and in with the elbow flexed in 30° (range 25-35°). An independent observer evaluated radiographs. Pain evaluation was self-defined by the patient as no, mild, moderate or severe.

Statistical Analysis

For statistical analyses we used the SPSS software package (SPSS, Chicago, Ill., USA). Discrete variables were presented as counts and percentages, continuous variables as Median and range unless otherwise stated.

Results

In all patients open reduction was performed.At initial treatment fracture stabilization was achieved in 13 cases by various DCP plates, 1 case was treated with an external fixator and K wires, due to soft tissue swelling, 1 case was treated with a titan elastic nail, and in one case plate fixation and a prosthesis for the radial head was implanted. The left elbow was involved in 13 cases, and the right in 3 cases. Cause of injury was fall in 12 cases, and MVA (Motor Vehicle Accident) in 4 cases. A total of 9 patients did not have additional injuries, 5 had additional injuries, and 2 patients were diagnosed as polytrauma.

A total of 3 complications occurred in 3 different patients, all treated with a DCP plate: one impaired sensibility in the fifth finger, one implant related sensation, and one fluid-blister at the DCP plate.

Impaired sensibility was due to a cubital tunnel syndrome developed 8 years after initial surgery. Decompression surgery and partial implant removal led to an improvement of the situation. Implant related sensation was observed 3 years after initial plating, and vanished after implant removal.In another case, a fluid-blister developed after 3 years around the implant, without signs of local or general infection. Relief of the fluid was performed at the same surgery as for implant removal.

8 additional fractures of the radial head were observed: 6 in Type II fractures, 1 in Type I fracture, and one in Type III fracture. No outcome related differences were detected due to the fractures of the radial head.

At the end of early follow-up, 15patients reported no pain, and 1 patient reported mild pain. Median flexion-extension arc was 118° (range, 83° - 145°). Median extension deficit was 9° (range 0° - 30°). Median supination-rotation arc was 148° (range 20° - 180°). Table 1 shows early follow-up characteristics. X-ray evaluation at early follow-up detected no signs of pseudarthrosis, implant failure or luxation of the radiocapitelar head.

Table.1 Early follow-up characteristics

Patient	Gender	TTS	Age	TTFU	Flexion	Exten Def	FE Arc	Pronation	Supination	SP Arc	Pain
#1	f	2	64	0	130	10	120	90	90	180	no
#2	f	0	63	2	120	10	110	90	90	180	no
#3	m	0	54	4	120	30	90	70	80	150	no
#4	f	0	61	0	110	10	100	90	90	180	no
#5	f	0	50	1	140	0	140	90	90	180	no
#6	f	0	67	2	140	10	130	90	90	180	no
#7	f	0	75	0	130	5	125	70	70	140	mild
#8	m	0	40	2	140	0	140	80	80	160	no
#9	f	0	22	1	145	0	145	90	90	180	no
#10	f	0	59	1	140	30	110	70	20	90	no
#11	f	0	29	2	135	0	135	90	90	180	no
#12	f	1	23	3	130	0	130	80	80	160	no
#13	m	0	34	7	125	30	95	60	50	110	no
#14	f	0	74	1	110	5	105	10	10	20	no
#15	f	0	47	1	83	0	83	40	60	100	no
#16	f	0	81	3	140	10	130	90	90	180	no
Median			53	2	127	9	118	75	73	148	
Minimum			23	0	83	0	83	10	10	20	
Maximum			81	7	145	30	145	90	90	180	

TTS: time to surgery (d)
TTFU: time to follow up from surgery (y)
FE Arc: flexion-extension arc (°)
SP Arc: supination-rotation arc (°)

At the long term follow-up 13patients reported no pain, and 3 patients reported mild pain. Median flexion-extension arc was 131° (range, 100° - 150°). Median extension deficit was 8° (range 0° - 30°). Median supination-rotation arc was 163° (range 90° - 180°). Improvement of flexion and flexion-extension arc was statistical significant ($p<0.005$) in comparison between early and long-term follow-up. Results for extension deficit, and supination-rotation arc were trend wise. Varus and valgus instability was observed at both follow-up time points, showing no signs of instability.

Morreyrating was excellent in 11 cases, good in 4 cases, and fair in 1 case. Median Oxford elbow score achieved 46 (range 37-48). Mayo elbow score rating resulted in all 16 cases excellent. Results for DASH score showed a median of 7.9 (range, 1.7-20.7). Table 2 shows the Long-term follow-up characteristics. Comparisons of the different results between early and late follow-ups are summarized in Table 3.

Table.2 Longterm follow-up characteristics

Patient	Gender	Age	FU	Felxion	Exten Def	FE Arc	Pronation	Supination	SP Arc	BMI Score	BMI Rating	Ofxord ES	Mayo ES	Mayo Rating	DASH	Pain
#1	f	68	5	150	10	140	90	90	180	100	Excellent	48	100	Excellent	3.3	no
#2	f	72	11	140	0	140	90	75	165	93	Excellent	41	100	Excellent	18.1	no
#3	m	62	12	130	0	130	90	75	165	100	Excellent	37	100	Excellent	19	no
#4	f	70	9	140	10	130	90	90	180	99	Excellent	48	100	Excellent	2.5	no
#5	f	62	13	130	10	120	90	90	180	97	Excellent	48	100	Excellent	6.7	no
#6	f	78	13	140	0	140	90	90	180	100	Excellent	48	100	Excellent	4.2	no
#7	f	85	10	130	0	130	80	80	160	82	Good	43	85	Excellent	15.5	mild
#8	m	52	15	150	10	140	90	90	180	100	Excellent	48	100	Excellent	2.5	no
#9	f	35	14	150	0	150	90	90	180	100	Excellent	48	100	Excellent	1.7	no
#10	f	72	14	140	10	130	90	70	160	99	Excellent	47	100	Excellent	5.2	no
#11	f	41	14	150	0	150	90	90	180	100	Excellent	48	100	Excellent	2.6	no
#12	f	28	8	140	0	140	90	90	180	100	Excellent	48	100	Excellent	1.7	no
#13	m	42	15	140	20	120	50	60	110	95	Excellent	48	100	Excellent	3.3	no
#14	f	89	15	120	10	110	45	45	90	77	Fair	41	85	Excellent	12.5	mild
#15	f	55	9	130	30	100	80	60	140	92	Excellent	46	100	Excellent	7.8	no
#16	f	89	11	140	10	130	90	90	180	85	Good	43	80	Excellent	20.7	mild
Median		63	12	139	8	131	83	80	163	95		46	97		7.9	
Minimum		28	5	120	0	100	45	45	90	77		37	80		1.7	
Maximum		89	15	150	30	150	90	90	180	100		48	100		20.7	

FU: time to follow up from surgery (y)
FE Arc: flexion-extension arc (°)
SP Arc: supination-rotation arc (°)
BMI Score: Broberg and Morrey
Oxford ES: Oxford elbow score
Mayo ES: Mayo elbow score
DASH: Disabilities of the Arm, Shoulder, and Hand
BMI Arth: Broberg and Morrey Arthrosis rating

Table.3 Differences between early and long-term results

Patient	Flexion	Exten Def	FE Arc	Pronation	Supination	SP Arc	Pain
#1	130/150	10/10	120/140	90/90	90/90	180/180	no/no
#2	120/140	10/0	110/140	90/90	75/75	180/165	no/no
#3	120/130	30/0	90/130	70/90	75/75	150/165	no/no
#4	110/140	10/10	100/130	90/90	90/90	180/180	no/no
#5	140/130	0/10	140/120	90/90	90/90	180/180	no/no
#6	140/140	10/0	130/140	90/90	90/90	180/180	no/no
#7	130/130	5/0	125/130	70/80	80/80	140/160	mild/mild
#8	140/150	0/10	140/140	80/90	90/90	160/180	no/no
#9	145/150	0/0	145/150	90/90	90/90	180/180	no/no
#10	140/140	30/10	110/130	70/90	70/70	90/160	no/no
#11	135/150	0/0	135/150	90/90	90/90	180/180	no/no
#12	130/140	0/0	130/140	80/90	90/90	160/180	no/no
#13	125/140	30/20	95/120	60/50	60/60	110/110	no/no
#14	110/120	5/10	105/110	10/45	45/45	20/90	no/mild
#15	83/130	0/30	83/100	40/80	60/60	100/140	no/no
#16	140/140	10/10	130/130	90/90	90/90	180/180	no/mild
Median	127/138	9/8	118/131	75/83	73/80	148/163	
Minimum	83/120	0/0	83/100	10/45	10/45	20/90	
Maximum	145/150	30/30	145/150	90/90	90/90	180/180	
p value	0.005	0.6	0.002	0.03	0.1	0.03	

FE Arc: flexion-extension arc (°)
SP Arc: supination-rotation arc (°)

Discussion

Although various studies related to Monteggia fractures have been published, long term results after surgical treatment can be seen as sparse [11]. In our present study we hypothesized those good results after Monteggia injuries can be achieved and maintained over a long-term period. This is in contrast to several publications, interrelating "Monteggia" with challenging therapy and pessimistic prognosis [5]. The lesion described in this article is particularly complex as it threatens the integrity of both elbow flexion and extension as well as forearm rotation [10].

The incidence of our fracture types can be seen comparable to other previous findings [6,10,11]. The most common Type II, and the seldom Type I in adults is represented in our study population in comparable percentages [6,11]. Even if the Bado classification is widely used, the correct labeling of those fractures is sometimes challenging [10,11,17]. The cause of injury in our study population is also comparable in the literature, even if we could detect only four cases of MVA associated fractures[5,6,11]. Gender distribution showed a clear prevalence for females, as described by Jupiter [10], but stands in contrast to previous findings [5,11].

We could not detect non-union rates as reported in earlier studies, possible reflecting the use of modern fixation devices and techniques as cited in the current literature [5,18,19]. External fixation and K-wire were used in one patient after MVA due to severe soft tissue swelling. Removal of the external fixator and the K-wires were performed 7 weeks after initial surgery. In another case initial plate fixation with an associated multifragmented radial head fracture was treated with radial head prosthesis in the same session, due tothe fact that a reconstruction of the radial head was impossible. Both patients achieved an excellent Brobergand Morrey score at long-term follow-up. We also have to mention the previously described complications.

Although the differences in range of motion between early and long-term follow-up did not show statistical significance in all areas, an improvement of functional outcomewas observed. At final follow-up, according to Broberg and Morrey rating, 13 patients performed "excellent", two "good" and one "fair". When looking at the Mayo rating, all 16 patients resulted in "excellent".

Limitations of the Study

There are several limitations of the current study, evaluated in a small population, we have to mention in relation to our results. The most gravid are the wide range of age, several surgeons performing the surgeries, and the lack of elbow scores at the early follow-up. Missing data based on radiographs at long-term follow-up were owed to the fact that not in all patients comparable radiographs were available for interpretation.

The strengths of our study are only adult patients, independent observers, state of the art surgical technique and a median follow-up period of 12 years.

Conclusion

Based on our data, surgical treatment in adult patients with Monteggia injuries showed improved results. Excellent rating according to Broberg and Morrey was achieved in 11 patients, good in 4 cases, and fair in one case after a median follow-up period of 12 years.

Acknowledgements: I want to give eminent credit for my parents and friends for their unlimited support for my research and when the sun was not shining. Special thanks to MJ and GE for their support, and to all volunteers, making this study possible.

Author Contributions: Kovar FM and Jaindl M contributed equally to this work; Jaindl M, Andreas Wippel designed the research; Kovar FM, Andreas Wippel and Jaindl M performed the research; Kovar F and Endler G analyzed the data; Kovar F and Jaindl M wrote the paper.

References

1. Lidder S, Heidari N, Amerstorfer F, Grechenig S, Weinberg AM. Median nerve palsy following elastic stable intramedullary nailing of a monteggia fracture: an unusual case and review of the literature. Case Report Med 2011; 2011:682454.
2. Scherl SA, Schmidt AH. Pediatric trauma: getting through the night. J Bone J Surg 2010; 92 (3):756-764.
3. Bado JL. The Monteggia lesion. ClinOrthop. 1967; 50:71-86.
4. Hung SC, Huang CK, Chiang CC, Chen TH. Monteggia type I equivalent lesion: diaphyseal ulna and radius fractures with a posterior elbow dislocation on an adult. Arch Orthop Trauma Surg 2003; 123:311-13.
5. Ring D, Jupiter JB, Simpson NS. Monteggia fractures in adults. J Bone J Surg 1998;80A:1733-44.
6. Reckling FW. Unstable fracture-dislocations ofthe forearm(Monteggia and Galeazzi lesions). J Bone Joint Surg 1982;64A:857-63.
7. Smith FM. Monteggia fractures: an analysis of 25 consecutive injuries. SurgGynecolObstet 1974; 85: 630-40.

8. Tompkins DG. The anterior Monteggia fracture. J Bone Joint Surg [Am]1971;53:1109-1114.
9. Tan J, Mu M, Liao G, Zaho G and Li J. Biomechanical analysis ofthe annular ligament in Monteggia fractures using finite element models. Journal of Orthop Surgery and Research 2015;10:30; DOI 10.1186/s13018-015-0170-3.
10. Jupiter JB, Leibovic SJ, Ribbans W, Wilk RM. The posterior Monteggia lesion. J Orthop Trauma 1991;5:395-402.
11. Guitton TG, Ring D, Kloen P. Long term evaluation of surgical treated anterior Monteggia fractures in skeletally mature patients. J Hand Surgery 2009;34A.1618-24.
12. Givon U, Pritsch M, Levy O, Yosephovich A, AmitYHoroszowski H. Monteggia and equivalent lesions: a study of 41 cases. ClinOrthopRelat Res 1997;337:208-15.
13. Müller ME, Nazarian S, Koch P, Schatzker J. The comprehensive classification of fractures of long bones. Berlin: Springer Verlag;1990:86-115.
14. KingGJ, Richards RR, Zuckermann JD, Blasier R, Dillman C, Friedman RJ, et al. A standardized method for assesment of elbow function. Research Committe, American Shoulder and Elbow Surgeons. J Shoulder Elbow Surg1999;8:351-4.
15. Veehof MM, Sleegers EJ, van Veldhoven NH, Schuurman AH, van Meeteren NL. Psychometric qualities ofthe Dutch language version ofthe Disabilities ofthe Arm, Shoulder, and Hand questionnaire (DASH-DLV). J Hand Ther 2002;15:347-54.
16. Jupiter JB, Morrey BF. Fractures of the distal humerus in the adult. In: Morrey B, Ed. The elbow and its disorders. Philadelphia: WB Saunders, 1993;328-66.
17. Biga N, Thomine JM. Trans-olecranal dislocations ofthe elbow. Rev ChirOrthopReparatriceApparMotil1974;60:557-67.
18. Egol KA, Tejwani NC, Bazzi J, Susarla A, Koval KJ. Does a Monteggia variant lesion result in a poor outcome? A retrospective study. ClinOrthopRelat Res 2005;438:233-38.
19. Reynders P, De Groote W, Rondia J, Govaerts K, Stoffelen D, Broos PL. Monteggia lesions in adults: a multicenter BOTA study. ActaOrthopBel 1996;62(Suppl 1):78-83.