

Utilization of the Clinical Pathway in the Management of Closed Unstable Supracondylar Fracture of the Distal Humerus in Children in a Tertiary Hospital

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Abstract - Clinical pathways have long been used to facilitate the delivery of care in different areas of medicine, composed of a set of pre-determined orders based on the most preferred management to standardize the care of certain conditions.¹⁻⁸ This is an analytical, retrospective, single-institution study aimed to determine its efficiency of the clinical pathway in the management of closed unstable supracondylar fractures in children. A total of 59 of 70 admitted patients aged 1-15 who sustained an isolated closed unstable supracondylar fracture included in the study. The patients were divided into two groups: the clinical pathway group and non-clinical pathway group. Demographic and clinical data were gathered through a chart review. The means between two groups were determined based on the time interval between initial emergency room consult to admission, admission to the start of the surgical procedure, admission to discharge and the total cost of treatment. Independent t-test was used to analyze data, with statistical significance set at p value < 0.05. This study demonstrated statistical and clinical significance in the pre-operative hospital stay by an improvement in the following variables: time of initial emergency room consult to admission from 15.79 hours to 7.03 hours (p-value=0.018, 55.5% change) and time of admission to the start of the surgical procedure from 16.79 hours to 6.39 hours (p=0.000, 61.9% change). However, duration from the time of admission to discharge and the total cost of treatment demonstrated clinical, but not statistical, significance (p=0.082, 17.1% change and p=0.303, 36.6 % change, respectively). The utilization of the clinical pathway significantly improved the pre-operative hospital stay from the initial emergency room consult to the start of the operative procedure, with no significant change in the post-operative hospital stay and the total cost of treatment.

Index Terms- clinical pathway, Gartland staging, supracondylar fractures

I. INTRODUCTION

Clinical pathways were used for more than 25 years to improve the total quality management of care in different areas of medicine as first introduced by Coffey et al in 1992. This is composed of a set of pre-determined orders based on the most preferred management to standardize the care of certain conditions. [1-8]

Supracondylar fractures in the pediatric population is the most common fracture in the elbow and one of the most common reasons for visit in the emergency department, ranging from 60.3 to 71.8 per 100,000 children annually.[9] Current consensus suggests surgical management of supracondylar humerus (SCH) fractures in children using modern techniques to decreased the malunion rates and compartment syndrome.[10]

The Department only have 23 out of the 300 beds in this institution, the utilization of such tool can facilitate the delivery of care by decreasing the pre-operative and post-operative hospital stay and decrease the cost of treatment. The use of the clinical pathway will help expedite admission to the hospital and improve patient experience and clinical management.

This study aimed to present the result after an initial run of the clinical pathway to determine its efficiency in the management of closed unstable supracondylar fractures (Gartland stage II-B, III and IV) in children admitted at a tertiary hospital.

II. MATERIALS AND METHODS

This is an analytical, retrospective, single-institution study. The research protocol was presented and approved by the Unified Research Ethics Review Committee. This includes all admitted patients from July 1, 2016 to June 30, 2019 with ages 1-15 who sustained an isolated closed unstable supracondylar fracture (Gartland stage IIB, III and IV) diagnosed by plain radiograph, who consulted within 7 days from injury, and manage with closed reduction and percutaneous pinning. The flowchart in the conduct of the study is shown in figure 1.

The medical records of the patients were gathered using the International Classification of Diseases Version 10 (ICD 10) with the diagnostic code S42.413A, “displaced simple supracondylar fracture without intercondylar fracture of unspecified humerus, initial encounter for closed fracture.” [11]

The patients were then be divided into two groups: the clinical pathway group and the non-clinical pathway group. The clinical pathway group includes all admitted patients from January 1, 2018 to June 30, 2019, who satisfied the inclusion criteria, enrolled in the clinical pathway during the initial run of the clinical pathway, treated with closed reduction and percutaneous pinning under C-arm guidance. The non-clinical pathway group includes all admitted patients in from July 1, 2016 to December 31, 2017 with closed unstable supracondylar

fractures managed with closed reduction and percutaneous pinning under C-arm guidance.

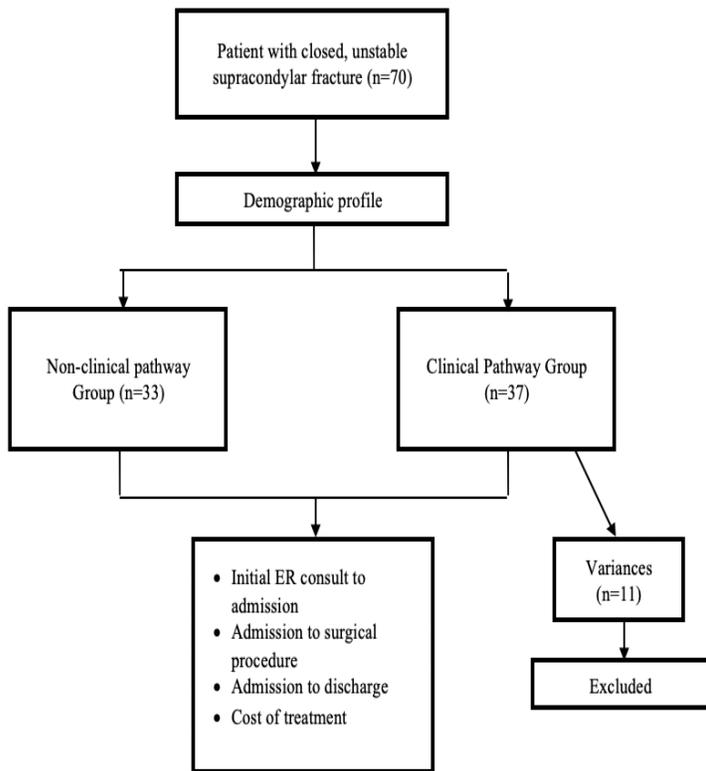


Figure 1. Flowchart of the conduct of study.

The data gathered were the following: age, sex, mechanism of injury, Gartland classification, date and time of initial consult at the emergency department, date and time that the operative procedure started, date and time of discharge and the cost of treatment.

The means of the following variables between the two groups were computed and tabulated: time interval from initial ER consult to admission, admission to surgical procedure, admission to discharge, and the cost of treatment.

The clinical significance and statistical significance between the computed means of the clinical pathway and non-clinical pathway groups were then determined based on the parameters set by the author. Statistical significance of each parameter was analyzed using independent t-test with a p value of 0.05. Statistical Package for Social Sciences (SPSS) version 23 was used to perform comparative analysis of the data gathered.

The clinical significance is determined by the institution based on previous studies, however, since this was the first clinical pathway, 15% improvement in the parameters based on the study of Sung *et al* was considered clinically significant.[12]

III. RESULTS

Fifty-nine patients were included in the study. The patients were divided into two groups: the clinical pathway group (n=26) and the non-clinical pathway group (n=33). As seen on table 1, supracondylar fractures most commonly occurs in

children 6-10 years (47.5%), followed by 0-5 year (40.7%) and 11-15 years (10.2%). Thirty-eight (64.4) patients were male and 21 (35.6%) were female. Fifty-eight (98.3%) of the patients had the injury secondary to fall and only 1 (1.7%) from a motor vehicular accident. With regards to the Gartland classification, 54 (91.5%) of the patients were stage III, 3 (5.1%) were stage IIB and 2 (3.4%) were stage IV, and all of which were extension type of injury.

Table 1. Demographic profile of patients

Variables	Non-clinical pathway group (n=33)	Clinical pathway group (n=26)	Total	(%)
Age				
0-5	16	8	24	40.7
6-10	14	15	29	47.5
11-15	3	3	6	10.2
Sex				
Male	21	17	38	64.4
Female	12	9	21	35.6
Mechanism of injury				
Fall	32	26	58	98.3
MVA	1	0	1	1.7
Gartland Classification				
Stage IIB	0	2	2	3.4
Stage III	33	21	54	91.5
Stage IV	0	3	3	5.1
Type				
Flexion	0	0	0	0
Extension	33	26	59	100

Table 2 shows the mean number of hours from initial emergency room consult to admission, from admission to the start of the operative procedure, from admission to discharge and the average cost of treatment before and after the implementation of the clinical pathway.

Table 2. Comparison of the variables between the non-clinical pathway vs the clinical pathway group

Outcome Variables	Non-clinical pathway group	Clinical pathway group	Mean difference	% change	P Value
Consult to Admission (hours)	15.79	7.03	8.76	-55.5	0.018
Admission to surgical procedure (hours)	16.79	6.39	10.40	-61.9	0.000
Admission to discharge (hours)	44.64	36.99	7.65	-17.1	0.082
Cost of treatment	2,474.95	1,568.48	906.47	-36.6	0.303

Figure 2 and figure 3 shows the outcome variables between the clinical pathway group and the non-clinical pathway group.

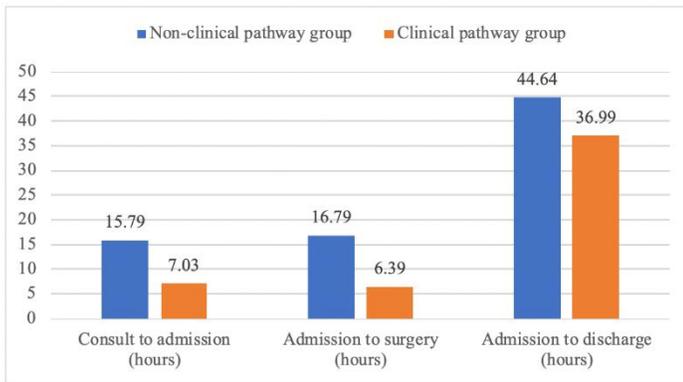


Figure 2. Outcome variables comparing the non-clinical pathway to the clinical pathway group.

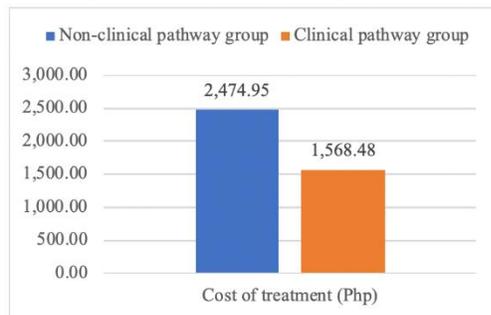


Figure 3. Cost of treatment.

IV. DISCUSSION

A number of studies reported the effectiveness of CP in the orthopedic procedure, including a pediatric supracondylar fracture, total knee arthroplasty, total hip arthroplasty and femur neck fracture.[3,4,8,12,13,14,15] Supracondylar fractures in this study mostly occurred in patients 6-10 years of age, with male predominance. The most common mechanism of injury is secondary to fall. All patients suffered from extension type fractures based on the Gartland classification of pediatric supracondylar fractures. These finding are in line with AAOS, wherein supracondylar fractures in children peaks at 5 to 6 years old and most often require surgery. Extension-type fractures secondary to fall onto an outstretched hand with the elbow in full extension accounts for approximately 97-99% of cases.[16]

After nine revisions, the clinical pathway was approved for implementation. In the study conducted by Sung *et al.*, a clinical pathway for treating supracondylar fractures was evaluated using electronic medical recording in patients who underwent closed reduction and percutaneous pinning. The length of hospital stays decreased by 15.0% after the implementation of the pathway. The total hospital cost decreased by 1.9% but this didn't exceed the non-inferiority margin. It concluded that the use of the clinical pathway enhanced the patient management without increase in cost and hospital stay. [12]

Based on the meta-analysis conducted by Barbieri *et al.*, use of clinical pathways in hip and knee arthroplasty shows significant reduction in post-operative complication rates, no significant difference in ratios discharge, decrease in hospital

stay and lower hospital cost.[14] This study demonstrated significance both clinically and statistically in the pre-operative hospital stay by an improvement in the following variables: time of initial emergency room consult to admission from 15.79 hours to 7.03 hours (p -value=0.018, 55.5% change) and time of admission to the start of the surgical procedure from 16.79 hours to 6.39 hours (p =0.000, 61.9% change). However, duration from the time of admission to discharge and the total cost of treatment demonstrated clinical, but not statistical, significance (p =0.082, 17.1% change and p =0.303, 36.6% change, respectively).

The study was conducted in a government hospital accredited by the Philippine Health Insurance Corporation which explains why there was no significant difference in terms of the cost of the treatment. Most patients were admitted in the charity accommodation under this health insurance program availed free treatment. This includes hospital accommodation, thereby, not significantly affecting the relationship of hospital stay and cost of treatment.[17] For this reason, the length of hospital stay was not included as one of the outcome variables because most of the patients are under charity accommodation and no additional cost for each day past the time the patient is for discharge. This variable would also be greatly affected by holidays and weekend regardless of being in the non-clinical pathway and clinical pathway group.

This study mainly focused to evaluate the efficiency in utilizing the clinical pathway in the management of pediatric supracondylar fractures. The development and implementation of the clinical pathway provided efficiency, in terms of the pre-operative hospital stay with no significant change in terms of hospital cost. Although there was no note of statistical difference in the cost of treatment, it could have a great impact in the socioeconomic status of the patients since most of them are admitted under charity accommodation. Based on the Department of Labor and Employment, the minimum wage for this region is about 310.00 – 395.00 Philippine pesos, a difference of 906.47 Philippine pesos is almost equivalent to three working days. [18]

The clinical pathway is a complex tool that requires constant development and its implementation provides the most efficient patient-focused care paradigm that eliminates delays, optimizes the use of hospital resources and facilitates of communication among team members and with patients.

V. CONCLUSION

The utilization of the clinical pathway in the management of closed, unstable supracondylar fractures in children significantly improved the treatment efficiency by a decrease in the duration of the pre-operative hospital stay from the initial emergency room consult to the start of the operative procedure, with no significant change in the post-operative hospital stay and the total cost of treatment.

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