Emergent closed reduction of cervical facet dislocations: effect of a standardised protocol and purpose-built table on time to reduction

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Abstract

Background

This study investigates the time to closed reduction of cervical facet joint dislocations using a standardised protocol and purpose-built reduction table compared to a historical control group.

Methods

This prospective cohort study was conducted at a tertiary referral hospital in South Africa and involved adults with cervical dislocations who underwent closed reduction. The intervention group included patients who were managed with a standardised protocol and purpose-built table, and the control group included patients managed with the traditional reduction method. Relevant data was extracted from medical records, and time to reduction, among other variables, was compared between groups.

Results

The study included 30 and 51 patients in the intervention and control groups, respectively. The time from contact with the orthopaedic consultant to the initiation of reduction was significantly shorter in the intervention group versus the control group, with a median of 1 h versus 9 h 15 min ($p < 0.001$). There was no association between use of the table and reduction success. However, there was a significant difference in neurological improvement: eight (40%) patients and five (12%) patients in the intervention and control groups, respectively ($p = 0.02$).

Conclusion

This study showed that an intervention within an orthopaedic department could decrease delay for closed cervical facet reduction in a resource-limited setting, despite wider systemic challenges. For this injury, any meaningful timesaving is invaluable due to the implications for neurological recovery, rehabilitation needs and long-term prognosis.

Level of evidence: 3

Keywords: cervical vertebrae, joint dislocations, closed reduction, neurological deficit, spinal cord injury

Introduction

Cervical facet dislocations are severe injuries, typically resulting from high-energy trauma such as motor vehicle accidents.[1,2] These dislocations may result in both primary and secondary injury to the spinal cord and have the potential for devastating outcomes, such as partial or complete paralysis.[3,4] Primary injury involves the acute mechanical damage of the original insult whereas secondary injury involves subsequent spinal cord compression and repercussions, such as ischaemia, oxidative stress and inflammation.[3] It has been postulated that the severity of the spinal cord injury is determined by the extent of the initial destruction and the duration for which the spinal cord was compressed.[3] Early reduction of the facet dislocation is thus critical for reducing the extent of secondary injury and optimising the likelihood of neurological recovery.[5,6] This, in turn, has profound implications for the patient's long-term prognosis.

Closed reduction is a well-established treatment option for cervical facet reduction among patients who are awake and orientated.[1,4,5,7] With this method, continuous axial traction is used to restore the spinal canal diameter and decompress the compromised spinal cord in an expedient and noninvasive manner. Stabilisation through surgical fixation can then take place at a later stage, as necessary.[5] While reduction should always be initiated as early as possible after the injury, previous studies found that

reduction within four hours[5] or six hours[6] was associated with a higher prevalence of neurological improvement post-reduction.

Achieving timeous reduction may be challenging, particularly in a resource-limited environment.[4,7] A previous study at our hospital, a tertiary referral facility in South Africa, found that one major source of delay was the time between the first orthopaedic consultation and initiation of the reduction attempt, a median of ten hours.[7] Reduction had traditionally been performed using incremental weights attached to a pulley system and applied to the skull via Cones callipers, which is a method associated with numerous problems. These included the time taken to collect and assemble the required components; the risk of a key item being missing or unavailable; the unstable nature of the apparatus; poor ability to titrate and control the traction applied by the weights; and poor ability to secure the patient in position, reducing the effective traction applied.[7]

To address these concerns, a dedicated cervical reduction table was designed and constructed by members of the orthopaedic department. Furthermore, a standardised protocol was developed for management of patients with cervical facet dislocations presenting to the hospital. These innovations were adopted as standard practice within the hospital. However, the effect of the intervention had not been formally evaluated. This study investigated the time to reduction of cervical facet dislocations using a standardised protocol and a purpose-built reduction table compared to a historical control group. A secondary aim was to compare reduction success rates between the methods.

Methods

Study design and setting

This cohort study was conducted at a tertiary referral hospital in South Africa, and included both a prospective and retrospective component. Prospective data collection was undertaken between January 2017 and August 2018 for patients who underwent cervical facet reduction using a standardised protocol and purpose-built reduction table (intervention group). Notably, the intervention refers to the combination of the standardised protocol and the reduction table as these elements were introduced simultaneously. Retrospective data collection was undertaken for a group of patients who had undergone cervical facet reduction using the traditional method between March 2009 and January 2016, at which time there was no standard protocol in place (control group). This retrospective data comprised a subset of data that was previously published.[7]

Patients

The study included all patients admitted to the casualty department of the hospital who were diagnosed with cervical uni- or bi-facet dislocation and managed with acute closed reduction. Patients were included regardless of whether there were fractures associated with the dislocations. Exclusion criteria for the study were patients < 18 years, comatose presentation, head soft tissue injury precluding pin placement, skull fractures, presentation at the hospital > 24 hours after injury and, in the case of prospective data collection, patients who declined to have their data included in the study.

Pre-reduction assessments

On admission, casualty officers stabilised the patient according to Advanced Trauma Life Support (ATLS) principles. Part of the stabilisation was immobilisation of the cervical spine in a rigid collar until there had been clinical and radiological investigations for spinal pathology. The casualty officer would then request the appropriate investigations and, upon diagnosis of a cervical dislocation, refer the patient to the orthopaedic consultant on call for further management.

A thorough neurological examination was performed, and skull traction was applied prior to initiating reduction. A prerequisite for closed reduction was a Glasgow Coma Scale > 14 such that the patient could communicate any worsening in symptoms or neurological function during the reduction attempt prompting abortion of the process by the treating physician.

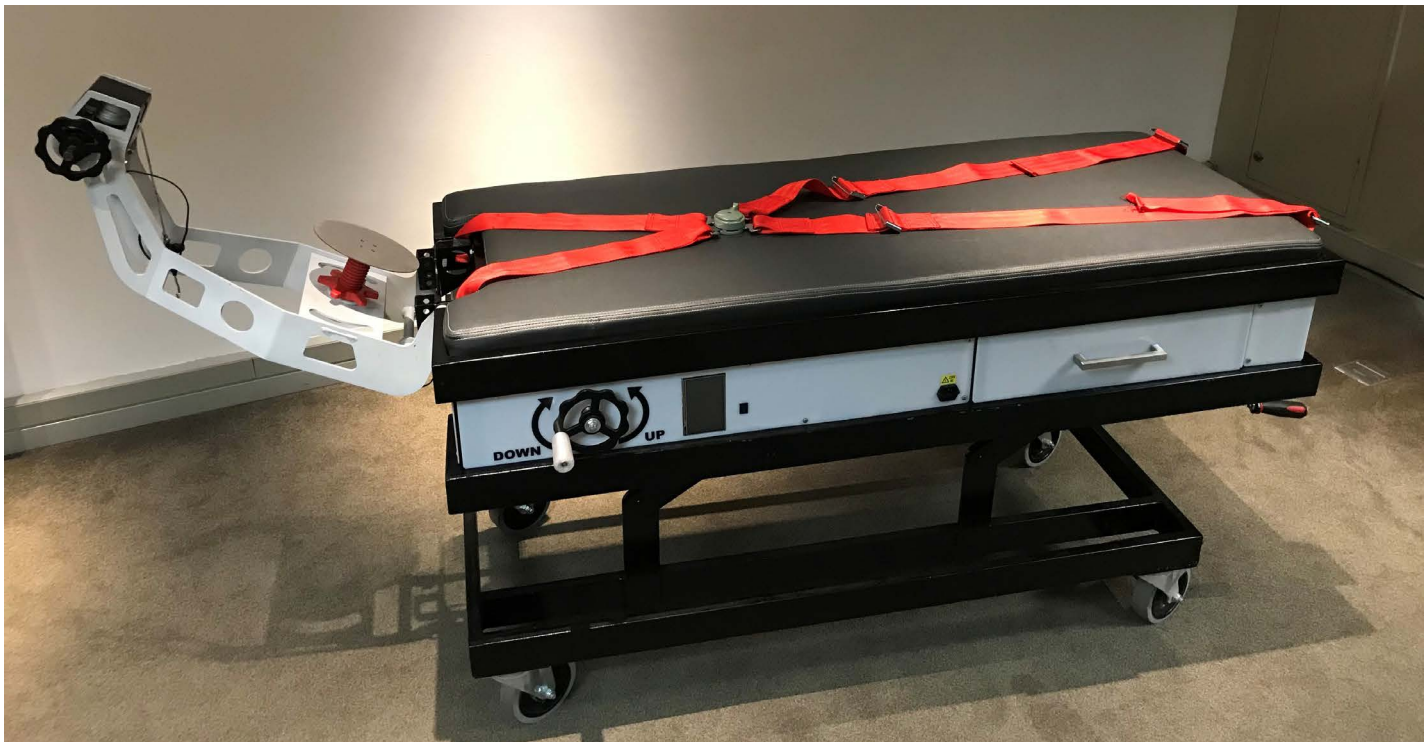

Figure 1. Purpose-built cervical facet dislocation reduction table

Intervention group reduction

A mobile reduction table was constructed to mimic the traditional closed reduction method of in-line traction (*Figure 1*). Patients were secured on the table with shoulder straps and the skull traction connected to the traction unit headpiece. Traction was set to maintenance weight (cranium 2.5 kg + 0.5 kg per level above level of injury), followed by removal of the rigid collar. Reduction was performed in the radiology suite, with imaging positioned for a lateral view of the cervical spine, centred on the injured level, to control and evaluate the sequential reduction process. All patients received conscious sedation and analgesia.

The standardised reduction technique consisted of first elevating the table headpiece to between 45° and 55° flexion while maintaining maintenance traction. Traction was then gradually increased in increments of 5 kg. Maximum weight was 60% of body weight. Neurological evaluation and a repeat radiograph accompanied any changes in traction or flexion angle. The traction weight and time was documented on each radiograph. After reduction was confirmed, patients were placed in 5–10° of extension on maintenance traction until such time as surgical stabilisation could be performed.

Control group reduction

The traditional method of closed cervical facet dislocation reduction used in our hospital has been described previously.[7] Briefly, it involved a stand-mounted pulley system attached to a normal hospital bed, and a sequential increase in weights. As with the reduction table, the reduction process was performed following removal of the rigid collar and with repeated neurologic and radiographic evaluation.

Data collection

Demographic data, mechanism of injury and neurological status were extracted from patient medical records. Radiographs were used to describe the dislocation and the level of the injury. Pre- and post-reduction neurological assessment were recorded as reported in the clinical notes and categorised according to the American Spinal Injury Association (ASIA) Impairment Scale. Reduction success, failure and any complications during the reduction procedure were also recorded. Finally, relevant time intervals were determined using data from the clinical notes and the time stamps on the reduction radiographs.

Data analysis

Continuous data was investigated for normal distribution, and presented using appropriate descriptive statistics. Categorical data was presented as frequency and percentage. Continuous variables were compared between groups using a Mann-Whitney U test. The association between the reduction group and categorical variables was investigated using a chi-square test or Fisher's exact test, as appropriate. Analyses were performed using jamovi version 1.6 (www.jamovi.org), with significance accepted at $p < 0.05$.

Results

A total of 81 patients met the criteria for the study and were included in the analysis: 30 patients in the intervention group and 51 patients in the control group. The characteristics of the included patients are shown in *Table I*. The groups had similar characteristics apart from a significant difference in the mechanism of injury profile.

Time frames

Time frames associated with the management of cervical spine dislocations in each group are presented in *Table II*. There was no significant difference between groups in the time from injury to casualty or from arriving at casualty to the first contact with the orthopaedic consultant on call. However, the time from contact with the consultant on call to the initiation of reduction was significantly shorter in the intervention group: 50% of reductions were initiated within 1 hour compared to 50% within 9 h 25 min in the control group. Overall, there was a strong trend towards a significantly shorter time from injury to the initiation of reduction in the intervention group compared to the control group ($p = 0.06$).

Table I: Patient clinical and demographic characteristics

	Intervention group (n = 30)	Control group (n = 51)	p-value
Age in years, median (IQR)	35 (25–42)	36 (28–46)	0.38
Sex			
Male	26 (87)	42 (82)	0.61
Female	4 (13)	9 (18)	
Mechanism of injury			
Fall from height	4 (13)	10 (20)	0.04*
Motor vehicle accident	15 (50)	35 (69)	
Assault	3 (10)	3 (6)	
Dive	0 (0)	1 (2)	
Low energy fall	6 (20)	2 (4)	
Unknown	2 (7)	0 (0)	
Injured level			
C2/3	2 (7)	0 (0)	0.52
C3/4	2 (7)	3 (6)	
C4/5	5 (17)	10 (20)	
C5/6	10 (33)	19 (37)	
C6/7	10 (33)	14 (28)	
C7/T1	1 (3)	5 (10)	
Dislocation[a]			
Uni-facet	17 (59)	26 (51)	0.51
Bi-facet	12 (41)	25 (49)	
ASIA score			
A	13 (43)	22 (43)	0.38
B	1 (3)	1 (2)	
C	2 (7)	6 (12)	
D	4 (13)	13 (26)	
E	10 (33)	9 (18)	

IQR: interquartile range; C: cervical; T: thoracic; ASIA: American Spinal Cord Injury Association Impairment Scale. All data are presented as frequency and percentage unless otherwise indicated.
a Missing data, intervention group, n = 1; *Significant at $p < 0.05$

Reduction process and outcomes

Details of the reduction process and outcomes of the first reduction attempt are shown in *Table II*. Twenty-six of 30 patients and 38 of 51 patients had successful reduction with the first attempt in the intervention and control groups, respectively. Of the 17 patients with an unsuccessful first reduction attempt, a second attempt was for a patient from the intervention group who had had initial failure due to dislodgement of the Cones callipers. This second attempt was made 8 h 18 min later and achieved successful reduction in 14 min with a weight of 20 kg. The patient's neurological status was unchanged from ASIA A following the initial attempt and subsequent successful reduction. No further closed reduction attempt was made for the remaining 16 patients with unreduced

Table II: Cervical spine dislocation reduction: time frames, process and outcome

	Intervention group (n = 30)	Control group (n = 51)	p-value
Time frames			
Injury to casualty, hours:min	3:27 (2:21–7:20)	3:30 (2:18–6:12)	0.96
Casualty to OCC, hours:min	7:14 (3:50–13:02)	8:00 (4:15–10:58)	0.97
OCC to initiation of cervical reduction, hours:min	1:00 (0:32–2:25)	9:15 (6:00–15:18)	< 0.001*
Overall delay			
Injury to initiation of cervical reduction, hours:min	13:18 (8:52–25:00)	17:30 (12:00–25:48)	0.06
Reduction process			
Reduction time, min	38 (22–88)	60 (41–93)	0.08
Weight applied, kg	28 (24–35)	21 (15–27)	0.002*
First attempt outcome			
Successful reduction, n (%)	26 (87)	38 (75)	0.26
Failed reduction, n (%)	4 (13)	13 (26)	
Neurological improvement[a]			
Yes, n (%)	8 (40)	5 (12)	0.02*
No, n (%)	12 (60)	37 (88)	
Neurological deterioration			
Yes, n (%)	0 (0)	2 (4)	0.53
No, n (%)	30 (100)	49 (96)	

OCC: orthopaedic consultant on call. Data are presented as median and interquartile range of hours:minutes. [a]Evaluation of improvement included only those patients with ASIA score A to D at baseline: intervention group, n = 20, control group, n = 42. *Significant at $p < 0.05$

Table III: Clinical and demographic characteristics of patients with high-energy injuries

	Intervention group (n = 19)	Control group (n = 46)	p-value
Age in years, median (IQR)	35 (29–43)	36 (29–45)	0.90
Sex			
Male	16 (84)	39 (85)	0.95
Female	3 (16)	7 (15)	
Mechanism of injury			
Fall from height	4 (21)	10 (22)	0.81
Motor vehicle accident	15 (79)	35 (76)	
Dive	1 (2)	0 (0)	
Injured level			
C3/4	2 (11)	3 (7)	0.63
C4/5	4 (21)	7 (15)	
C5/6	4 (21)	17 (37)	
C6/7	8 (42)	14 (30)	
C7/T1	1 (5)	5 (11)	
Dislocation[a]			
Uni-facet	10 (56)	21 (46)	0.48
Bi-facet	8 (44)	25 (54)	
ASIA score			
A	9 (47)	20 (44)	0.87
B	0 (0)	1 (2)	
C	1 (5)	5 (11)	
D	4 (21)	11 (24)	
E	5 (26)	9 (20)	

IQR: interquartile range; C: cervical; T: thoracic; ASIA: American Spinal Cord Injury Association Impairment Scale. All data are presented as frequency and percentage unless otherwise indicated. [a]Missing data, intervention group, n = 1

facets. While the reasons for this were not systematically recorded, they were generally related to contraindications such as a bone fragment blocking reduction or a worsening of neurological status.

Reduction using the table showed a trend towards a shorter reduction time and was associated with the use of significantly heavier applied weight. There was no significant association between use of the table and successful reduction. However, there was a significant association between use of the table and neurological improvement among patients with an initial ASIA score between A and D. In the intervention group, four patients improved from ASIA score A to score C, and four patients improved from ASIA score D to E. Neurological changes in the control group were as follows: two patients improved from ASIA score A to C; one patient improved from ASIA score A to B; one patient improved from ASIA score C to D; and one patient improved from ASIA score D to E.

High-energy injuries only

The significant difference in mechanism of injury between the groups involved differences in the distribution of high and low energy injuries *(Table I)*. To explore the possible role of this difference on the findings, a subanalysis was conducted including only confirmed high-energy injuries: fall from a height, motor vehicle accident or dive. Characteristics of the patients included in the subanalysis are shown in *Table III* and outcomes in *Table IV*. The subanalysis findings were similar to that of the main study, with a significantly shorter time from the first contact with the orthopaedic consultant on call to the initiation of reduction, a trend towards heavier reduction weight and a significantly greater proportion of patients with neurological improvement following reduction (*Table IV*).

Discussion

The time from injury to reduction of a cervical facet dislocation has major implications for the prognosis of the injured patient.[5,6] The first finding of the study was that implementation of a standardised

Table IV: Cervical spine dislocation reduction in patients with high-energy injuries: time frames, process and outcome

	Intervention group (n = 19)	Control group (n = 46)	p-value
Time frames			
Injury to casualty, hours:min	2:48 (1:45–4:27)	3:32 (2:21–6:04)	0.24
Casualty to OCC, hours:min	8:10 (5:03–13:02)	8:29 (4:14–10:59)	0.68
OCC to initiation of cervical reduction, hours:min	0:39 (0:24–2:03)	9:38 (6:00–15:24)	< 0.001*
Overall delay			
Injury to initiation of cervical reduction, hours:min	11:18 (8:58–26:00)	17:00 (12:00–25:06)	0.15
Reduction process			
Reduction time, min	37 (21–97)	63 (41–98)	0.17
Weight applied, kg	25 (20–34)	22 (15–27)	0.08
First attempt outcome			
Successful reduction, n (%)	17 (90)	33 (72)	0.12
Failed reduction, n (%)	2 (10)	13 (28)	
Neurological improvement[a]			
Yes, n (%)	7 (50)	4 (11)	0.002*
No, n (%)	7 (50)	33 (89)	
Neurological deterioration			
Yes, n (%)	0 (0)	1 (3)	0.53
No, n (%)	14 (100)	36 (97)	

OCC: orthopaedic consultant on call. Data are presented as median and interquartile range of hours:minutes [a]Evaluation of improvement included only those patients with ASIA score A to D at baseline: intervention group, n = 14, control group, n = 37. *Significant at p < 0.05

protocol and a purpose-built reduction table showed a strong trend towards a decreased time from injury to the initiation of reduction, compared to a historical control group. There was no difference between the groups regarding the time from injury to arrival at casualty or from arrival at casualty to the first contact with the orthopaedic consultant on call. Thus, the decreased delay appeared to be largely due to a significant decrease in the time from the first contact with the orthopaedic consultant on call to the initiation of reduction.

Factors related to pre-hospital delays and emergency room delays for cervical facet reductions have been described previously and may include the unequal distribution of specialist services in urban and rural areas, the availability of ambulance services, a large patient care burden on clinical personnel and the nature and severity of the patient's other injuries.[4,7,8] Many of these factors are systemic and largely beyond the control of the receiving orthopaedic department. However, previous studies suggest that, within resource-limited settings, there may also be substantial delays within the orthopaedic department itself including the availability of the necessary equipment.[4,7] The current findings suggest that a standardised protocol and simplification of the equipment requirements by a dedicated reduction table shortened the median time from the initial orthopaedic evaluation to the initiation of reduction from 9 h 25 min to 1 h 00 min. This large change is likely multifactorial. There was no longer time required to locate and assemble the traditional reduction apparatus (including an available hospital bed). Furthermore, the registrar on call was typically handling multiple emergency cases concurrently and may have previously had difficulty leaving the busy casualty unit for the time required to organise the traditional reduction apparatus. Having the dedicated table readily available may have meant that it was easier to perform the reduction sooner, between managing other patients. It is acknowledged that surgeon enthusiasm for use of the novel reduction device is likely to have played some role in the earlier initiation of reduction.

The second finding was that although the reduction success rate was somewhat higher using the reduction table, this difference was not statistically significant. Comparable success rates may be explained by the fact the reduction table was designed to mimic the original reduction apparatus, albeit in a more stable and controlled manner, and thus may have similar efficacy. Previous findings suggest notable variation in closed reduction success rates between studies.[4,6,9,10] However, the current reduction success rates were in keeping with overall reduction success rates of 75%[10] and 80%[9] reported in large, combined case series.

Further findings of the study were that there was a trend towards a decrease in the time taken to perform the reduction using the reduction table, and use of the table was associated with a larger proportion of patients with improved neurology following reduction compared to the control group. It is hypothesised that the latter finding may be related to the shorter time from injury to initiation of reduction in the intervention group. Earlier reduction would be associated with a shorter time of spinal cord compression and a potentially lower risk of permanent neurological damage.[3] Thus, while the reduction table may not necessarily improve reduction success rates, increased efficiency in initiating and performing the reduction may be of benefit for neurological recovery in some cases.

Finally, it was noted that use of the reduction table was associated with significantly heavier reduction weight than that of the control group. While this did not statistically improve reduction success, it may reflect a stronger and more stable system. As in previous studies, C5/6 and C6/7 were the most common sites of injury.[1,2,6] These more caudal dislocations tend to require heavier weights for reduction;[1] thus safer titration of heavier weights may be a possible qualitative advantage of using a purpose-built reduction table.

Low-energy falls may be associated with a more favourable outcome than high-energy falls, and the higher proportion of low-energy falls in the intervention group presented a possible source of confounding. A subanalysis including only high-energy injuries was performed to explore this concern. The subanalysis showed broadly similar findings to the main study, and the intervention remained significantly associated with reduced time from the first orthopaedic consultation to the initiation of reduction and a higher

proportion of neurological improvement. P-values increased for time from injury to the initiation of reduction, reduction time and weight applied, indicating a weaker association with the intervention in the subanalysis. However, this may be at least partly explained by loss of statistical power with the reduced sample size.

Limitations of the current study included the fact that the standardised protocol and the reduction table were introduced concurrently, and it was not possible to distinguish the relative influence of these elements, or the element of surgeon enthusiasm, on the study findings. Reliance on the accuracy and completeness of routine medical record data for the historical control group was a further limitation. In the case of the intervention group, the study period started approximately one year after the introduction of the table and may not reflect any learning curve that may have taken place.

Lastly, it is noted that the reduction table used in the study was an in-house clinical intervention designed and built by one of the co-authors, who was part of the clinical staff of the orthopaedic department at the time. It has since come to our attention that a cervical spine traction unit is commercially available from a developer in New Zealand.[11]

Conclusion

This study found that a standardised protocol and purpose-built cervical reduction table significantly decreased the time from the first orthopaedic consultation to the initiation of reduction among patients indicated for closed cervical facet reduction at a tertiary hospital in South Africa. The reduction table did not significantly improve reduction success rate. However, a higher proportion of patients showed neurological improvement following use of the table, possible due to more timely reduction. The overall time from injury to reduction within our setting remained much longer than the target of less than four to six hours. Nevertheless, this study showed that an intervention within a tertiary orthopaedic department could decrease delay for closed cervical facet reduction in a resource-limited setting, despite wider systemic challenges. For this injury, any meaningful timesaving is invaluable due to the implications for neurological recovery, rehabilitation needs and long-term prognosis.

Ethics statement

The authors declare that this submission is in accordance with the principles laid down by the Responsible Research Publication Position Statements as developed at the 2nd World Conference on Research Integrity in Singapore, 2010.

Prior to commencement of the study, ethical approval was obtained from the following ethical review board: Health Research Ethics Committee, Stellenbosch University, South Africa, reference number S18/10/264. All procedures were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008. Patients recruited prospectively signed written informed consent to participate in the study and a waiver of consent was approved for patients included in the retrospective analysis.

Declaration

The authors declare authorship of this article and that they have followed sound scientific research practice. This research is original and does not transgress plagiarism policies.

Author contributions

DHSB: study design, design of testing set-up, study conceptualisation, first draft preparation, manuscript preparation
MP: data analysis
AK: data collection
TNM: data analysis, manuscript revision
JHD: manuscript revision

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References

1. McDonald CL, Daniels AH, Anderson GA, et al. Traumatic cervical facet fractures and dislocations. JBJS Rev. 2022;10. https://doi.org/10.2106/JBJS.RVW.22.00023
2. Mubark I, Abouelela A, Hassan M, et al. Sub-axial cervical facet dislocation: a review of current concepts. Cureus. 2021;13:e12581. https://doi.org/10.7759/CUREUS.12581
3. Anjum A, Yazid MD, Daud MF, et al. Spinal cord injury: pathophysiology, multimolecular interactions, and underlying recovery mechanisms. Int J Mol Sci. 2020;21:1-35. https://doi.org/10.3390/IJMS21207533
4. Adeolu AA, Ukachukwu AEK, Adeolu JO, et al. Clinical outcome of closed reduction of cervical spine injuries in a cohort of Nigerians. Spinal Cord Ser Cases. 2019;5:17. https://doi.org/10.1038/S41394-019-0158-Z
5. Newton D, England M, Doll H, Gardner BP. The case for early treatment of dislocations of the cervical spine with cord involvement sustained playing rugby. J Bone Joint Surg Br. 2011;93:1646-52. https://doi.org/10.1302/0301-620X.93B12.27048
6. Nagata K, Inokuchi K, Chikuda H, et al. Early versus delayed reduction of cervical spine dislocation with complete motor paralysis: a multicenter study. Eur Spine J. 2017;26:1272-76. https://doi.org/10.1007/S00586-017-5004-Z
7. Potgieter M, Badenhorst DH, Mohideen M, Davis JH. Closed traction reduction of cervical spine facet dislocations: Compelled by law. S Afr Med J 2019;109(11):854-58. https://doi.org/10.7196/SAMJ.2019.v109i11.14017
8. Eranki V, Koul K, Mendz G, Dillon D. Traumatic facet joint dislocation in Western Australia. Eur Spine J. 2016;25:1109-16. https://doi.org/10.1007/S00586-014-3627-X
9. Gelb DE, Hadley MN, Aarabi B, et al. Initial closed reduction of cervical spinal fracture-dislocation injuries. Neurosurgery. 2013;72 Suppl 2:73-83. https://doi.org/10.1227/NEU.0B013E318276EE02
10. Storey RN, Singhal R, Inglis T, et al. Urgent closed reduction of the dislocated cervical spine in New Zealand. ANZ J Surg. 2018;88:56-61. https://doi.org/10.1111/ANS.14231
11. Spinal Traction Unit. https://www.spinaltraction.co.nz/. Accessed 25 Apr 2023.