

Evaluation of Acute Surgical Intervention in Traumatic Paraplegia

Conal B. Wilmot, M.D.¹ and Karyl M. Hall, Ed.D.²

¹Chairman, Department of Physical Medicine and Rehabilitation, Santa Clara Valley Medical Center, 751 So. Bascom Avenue, San Jose, California 95128, U.S.A.

¹Director and ²Co-Director, Northern California Regional Spinal Injury System, Institute for Medical Research, 2260 Clove Drive, San Jose, California 95128, U.S.A.

Summary

A retrospective study was conducted over a two-year period of 95 consecutive admissions for traumatic paraplegia. The average age was 32 years. Seventy-two (76%) of these patients had acute surgical intervention. Fifty had Harrington rod placement with posterior fusion, 10 had additional laminectomy and one had rodding and anterior fusion. Seven laminectomies (alone) were performed at other hospitals.

For those with rodding and/or fusion, rehabilitation stay was 70 days; for those with no surgery, 81 days. This difference was not statistically significant. However, when days of acute medical/surgical and rehabilitation hospitalization were combined, those having spinal surgery of any kind had a significantly shorter stay than those not having surgery (95 vs. 136 days). Complications were significantly greater in the patients who underwent internal fixation surgery. The neurological condition did not appear to be jeopardized by rodding and fusion.

Key words: Paraplegia; Spinal Surgery; Outcome; Medical Complications; Cost.

Introduction

Controversy exists over the acute care of the traumatically spinal cord injured individual (Ahn *et al.*, 1984). One disputed issue is whether to provide surgical intervention for the paraplegic, and if so, the type and the reason. Sir Ludwig Guttmann advocated that maintaining the patient in bed for 12 weeks in hyperextension, i.e. postural reduction, would reduce a significant number of bony injuries and allow the spine to fuse (Guttmann, 1973). Jacobs *et al.* (1980) reported positive results in 100 patients using reduction and Harrington rod internal fixation when compared with patients treated with Meurig-Williams plates or recumbency. Anatomical reduction and neurological improvement was increased and there was a reduction in time to wheelchair mobilization, time for rehabilitation and of complications.

Bedbrook (1979) cites several authors who advocate less surgical intervention.

He concludes, after extensive review of the literature supporting both schools of thought, that operative procedures have not been justified for the most part, although few studies have provided definitive data on the topic. The controversy is discussed also by Ahn *et al.* (1984), who found that Harrington rod instrumentation and bony fusion provided improved health care, being associated with the shortest hospital stay. However, Ahn *et al.* (1984) did not investigate differential complications:

The purpose of this study is to determine the outcome of acute surgical intervention in terms of changes in neurological status, medical complications, and length of in-hospital rehabilitation stay. Hopefully this information will shed more light on methods for optimal spinal cord injury (SCI) care.

Materials and Methods

A retrospective review of medical records for 2 years (between 9/1/81 and 8/31/83) was completed to identify the characteristics of all paraplegic SCI patients admitted consecutively to our rehabilitation program. Ninety-five paraplegics were identified, i.e., 47% of admissions. The average age was 32 years and 79% (75/95) were male. The majority sustained their SCI in a motor vehicle accident (52%) or in a fall (25%). Another 11% had had gunshot wounds. Median days from injury to Santa Clara Valley Medical Center (SCVMC) rehabilitation admission for those who had surgery at SCVMC was 1.5, and for surgery elsewhere, 29.5 days. For those who had no surgery median days was 31. Average days spent in hospital rehabilitation for the total sample was 72. Fifty-six had complete neurological lesions on admission.

Data on medical complications in-hospital that could be related to surgical intervention, type of surgery and Frankel Class at admission and discharge from the rehabilitation unit were obtained from records.

At the Northern California Regional Spinal Injury System, the rationale for acute surgical intervention is to:

1. preserve or improve neurological function.
2. reduce the bony deformity.
3. stabilize the spine.
4. mobilize the patient as soon as possible.

The indications for surgical intervention are based upon stability vs. instability of the fractures. Completeness vs. incompleteness of the neurological lesion determines the type of surgery. In stable fractures, if the patient is complete neurologically he will be mobilized as soon as medically stable without a brace, e.g. in an uncomplicated case, within one week of injury. If the patient has a stable fracture and is incomplete neurologically, he will be mobilized in a Jewett-Taylor brace with no surgical intervention as soon as he is medically stable.

The criteria for initial instability in thoracic or thoracolumbar injuries are:

- a) Translation/dislocation,
- b) Widening of the pedicles, or
- c) Fractured ribs at the level of injury.

The CT scan and surgical interventions show that the actual damage was more extensive than is seen in plain X-rays.

In unstable fracture dislocations, if the patient has a complete neurological

lesion, Harrington distraction rodding, posterior fusion, and sublaminar wiring will be carried out.

The rodding normally involves two levels above and below the fracture site. As many levels as possible are wired. If every level including the fractured vertebrae are wired the patient is mobilized in one week without any brace. For every level left unwired, one month in the Jewett-Taylor Brace is prescribed.

If the patient has an incomplete neurological lesion with fracture dislocation, Harrington rod distraction with intraoperative pantopaque myelogram will be carried out. If there is free flow of dye (i.e., the spinal cord is decompressed) posterior fusion and sublaminar wiring is carried out. If there is a block to the flow of the dye it is usually an anterior block. Anterior decompression is performed sufficient to relieve the block, than an anterior fusion with rib bone graft is done, followed by posterior fusion and sublaminar wiring. Mobilization proceeds as in complete lesions.

If the patient has a cauda equina lesion, an initial CT metrizamide myelogram is done. If the spine is unstable, and bony fragments are pressing on the peripheral nerves, or there is pressure from the posterior elements, a decompressive laminectomy and posterior stabilization, fusion and wiring are then done.

Result

Seventy-six percent of the 95 paraplegics had acute surgical intervention. Of those having surgery, 50/72 or 69% had Harrington rod placement with posterior fusion, and 21 (29%) had laminectomy with or without rodding or fusion (Table 1).

Table 1 Acute Surgical Intervention in Paraplegics

Type of Surgery	SCVMC		Elsewhere		Total		°o (N/95)
	N	*	N	*	N	*	
1. Harrington Rod Alone (HR)	—	—	1	—	1	—	1.1
2. HR with Posterior Fusion	31	15	19	5	50	20	52.6
3. HR with Anterior/Posterior Fusion and Laminectomy	—	—	1	—	1	—	1.1
4. HR with Laminectomy	—	—	3	—	3	—	3.2
5. HR with Posterior Fusion and Laminectomy	5**	3	4	—	9	3	9.4
6. Laminectomy Alone	—	—	7	—	7	—	7.3
7. Laminectomy with Posterior Fusion	—	—	1	1	1	1	1.1
Subtotal (Surgeries)						72	75.8
No Surgery						23	23.2
Total						95	100

* with mention of wiring

** two of five laminectomies (alone) done at other hospitals (thoracic); HR and posterior fusion were done consequently at SCVMC. Other three were cauda equina lesions, laminectomies done at SCVMC.

For those with rodding and/or fusion (N = 65), the rehabilitation stay was an average of 70 days (including the 7 laminectomies, 69 days); for those with no surgery (N = 23), 81 days. The difference in days was not statistically significant (t = 0.91). Median lengths of stay were 67.5 and 67 days respectively. However, when days of acute medical/surgical hospitalization and rehabilitation stay were

Table 2 Days of Hospitalization from Injury to Rehabilitation Discharge

	No Surgery	Surgery at SCVMC	Surgery Elsewhere	t	p
M	136.1	89.3	99.5	1 & 2: 3.494	.001
SD	61.9	40.3	46.7	1 & 3: 2.604	.02
N	23	35	37	2 & 3: 0.9873	
Median	132	85	87		
Range	52-274	24-200	36-218		

M = mean

SD = standard deviation

N = number at patients

combined, a significant difference in days was found between those having surgery of any kind and those not having surgery (Table 2). This finding held true regardless of where the surgery had occurred, at SCVMC or elsewhere. Those having surgery were significantly hospitalised for less time than those not having surgery.

Thirty-eight percent (25/65) of patients who had internal fixation surgery had complications within their rehabilitation stay, possibly but not with certainty decisively due to the surgery. Seventeen percent (4/23) of those not requiring surgery had complications (Table 3). This percentage difference in complications between those having and not having internal fixation surgery is statistically significant ($z = 1.85$, $p < .05$, one tailed). For those having surgery, no difference in the proportion of complications was seen between SCVMC and elsewhere. Of those with complications whilst in hospital, thrombophlebitis was the commonest (40%—12/30) followed by pulmonary embolism (20%—6/30). One of the seven patients who had a laminectomy (alone) reported complications. All who had laminectomies (alone) were treated at other hospitals and are not included in the data in Table 3.

Table 3 Medical Complications for Paraplegics Having No Surgery versus Internal Fixation Surgery

Complication	No Surgery		Surgery		% (N/88)
	SCVMC	Elsewhere	SCVMC	Elsewhere	
Thrombophlebitis	1	0	5	6	13.6
Pulmonary Embolism	0	1	1	4	6.8
Pneumonia	0	1	2	0	3.4
Other Respiratory	0	1	2	1	4.6
Decubiti	0	0	0	1	1.1
Pneumothorax	0	0	1	2	3.4
Totals	1	2	11	14*	

*two patients had more than one complication

Nine of the 95 paraplegic patients improved in Frankel Class between admission and discharge from rehabilitation. Eighty-five had no change and one worsened (see Table 4). Of the 9 who improved, 3 had no surgery, Five had rodding and fusion, and 1 had laminectomy and fusion.

Table 4 Change in Frankel Classification Between Rehabilitation Admission and Discharge

AA 54	AB	AC	AD	AE
BA 1	BB 3	BC	BD 2	BE
CA	CB	CC 7	CD 6	CE
DA	DB	DC	DD 20	DE 1
EA	EB	EC	ED	EE 1

Discussion

Eighty-nine percent of surgeries performed included Harrington rodding with wiring and/or posterior/anterior fusion. Over half of the paraplegic patients admitted to the centre had internal fixation.

Groups studied by those having rodding and/or fusion compared to patients who did not have surgery showed similar lengths of rehabilitation stay. However, when the total number of hospital days (injury to rehabilitation discharge) was taken into consideration, a significantly shorter period of hospitalization occurred for those having surgery—an average difference of 36 days and 46 days, depending on whether surgery was elsewhere or at SCVMC. This translates into a significant cost savings, even considering surgical charges. An additional advantage is early mobilization of the patient. It is suspected that the average length of hospitalization would increase even more if surgical patients had not had surgery. Patients in our centre who had no surgery were stable and would be expected to require less rehabilitation.

Complications were significantly greater in the patients who underwent internal fixation surgery. Thrombophlebitis was most common, followed by pulmonary embolism.

If recumbency were an alternative treatment, results are not supportive of surgical intervention, based solely on the incidence findings of complications. It is difficult to get a complete or accurate picture of complications obtained only from a retrospective review of medical records. However, there is no reason to believe that a bias was exercised because reporting was blind to surgical status. Using SCVMC criteria, it was not possible to ascertain how many patients, if not provided with early surgical stabilization, might have required late surgery for progressive spinal instability. Neurological/functional status does not appear to be jeopardized by rodding and fusion, as the percentage improvement is comparable with those not receiving surgery. Those receiving other types of spinal surgery did not show the same degree of improvement.

Acknowledgements

The treatment protocol as outlined was developed primarily through interaction with Richard D. Hamilton, M.D., Chief of Neurosurgery, Glenn G. Reynolds, M.D., Physiatrist, and Steven Fountain, M.D., Chief of Orthopedic Surgery. Grateful appreciation is extended to these individuals for their invaluable contributions to the program.

This research was supported in part by the Northern California Regional Spinal Injury System, Grant No. G008435010, Project No. 128EH40013, from the Rehabilitation Services Administration, U.S. Department of Education, Washington, D.C.

Résumé

On a mené une étude rétrospective pendant une période de deux ans sur 95 souffrants consécutifs admis pour la paraplégie traumatique. L'âge moyen était de 32 ans. Soixante-douze (76%) de ces souffrants ont eu une intervention chirurgicale aiguë. Cinquante en avaient une mise en place de bâtonnets Harrington avec fusion postérieure, 10 en avaient une laminectomie supplémentaire et un souffrant avait l'insertion de bâtonnets et une fusion antérieure. Sept laminectomies (seulement) ont été effectuées à d'autres hôpitaux.

Pour ceux qu'on a traités par l'insertion de bâtonnets et/ou par la fusion, la durée du séjour de réhabilitation était de 70 jours; pour ceux qui restaient sans intervention chirurgicale, 81 jours. Cette différence n'était pas statistiquement significative. Cependant, lorsqu'on combinait les jours d'hospitalisation pour un traitement médical/chirurgical aigu et pour la réhabilitation, ceux qui avaient subi n'importe quelle intervention chirurgicale vertébrale ont eu une hospitalisation significativement plus courte que ceux qui n'avaient subi aucune intervention chirurgicale (95 jours contre 136). Les complications étaient significativement plus marquées chez les souffrants qui ont subi une intervention chirurgicale interne de fixation. La condition neurologique ne paraissait aucunement souffrir de l'insertion de bâtonnets ni de la fusion.

Zusammenfassung

Man hat während eines 2-jährigen Zeitraums ein rückblickendes Studium von 95 für traumatische Paraplegie aufeinanderfolgend aufgenommenen Patienten geführt. Das Durchschnittsalter war 32 Jahre. Zweiundsiebzig (76%) von diesen Patienten haben akuten chirurgischen Eingriff gehabt. Fünfzig davon hatten Einfügung von Harrington-Stäbchen zusammen mit hinterer Wirbelvereinigung, 10 hatten zusätzliche Laminektomie, und ein Patient hatte Stäbchen-Einfügung zusammen mit vorderer Wirbelvereinigung. Sieben Laminektomien (alleine) wurden in anderen Krankenhäusern ausgeführt.

Für die mittels Stäbchen-Einfügung und/oder Wirbelvereinigung behandelten Patienten betrug die wiederherstellungsmässige Unterbringung im Krankenhaus 70 Tage; für die ohne chirurgischen Eingriff behandelten 81 Tage. Dieser Unterschied war statistisch unbedeutend. Doch, wenn man die für akute medizinische/chirurgische Behandlung und für Wiederherstellung notwendigen Tage der Unterbringung im Krankenhaus kombinierte, hatten die mit irgendeiner Rückengratchirurgie behandelten Patienten eine bedeutend kürzere Unterbringung im Krankenhaus, als die ohne chirurgischen Eingriff behandelten (95 Tage gegen 136). Komplikationen waren bedeutend grösser bei Patienten, die eine interne Fixationschirurgie erlitten haben. Der neurologische Zustand schien nicht, durch Stäbchen-Einfügung und Wirbelvereinigung beeinträchtigt zu werden.

References

- AHN JH, RAGNARSSON KT, GORDON WA, GOLDFINGER G & LEWIN HM 1984 Current trends in stabilizing high thoracic and thoracolumbar spinal fractures. *Archives of Physical Medicine and Rehabilitation*, 65, 366-369.
- BEDBROOK GM 1979 Spinal injuries with tetraplegia and paraplegia. *Journal of Bone and Joint Surgery*, 61-B, 267-284.
- GUTTMANN L 1973 *Spinal Cord Injuries: Comprehensive Management and Research*. Blackwell Scientific Publications: London.
- JACOBS RR, ASHER MA, SNIDER RK 1980 Thoracolumbar spinal injuries. A comparative study of recumbent and operative treatment in 100 patients. *Spine*, 5, 463-477.