Personal Practice

SPINE INSTRUMENTATION: ASSESSMENT OF MORBIDITY RELATED TO 250 CASES

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Study design: A retrospective review of the morbidity associated with 250 consecutive cases of spinal instrumentation carried out in a neurosurgical spine unit. Objectives: To examine associated risk factors and results of treatment of those patients who sustained morbidity as a result of spinal instrumentation. **Methods:** The case records and imaging of all patients who had undergone spinal instrumentation at any level for any pathology were studied for morbidity related to the instrumentation used. They were followed up between 3 months to 8 years. **Results:** Over an 8-year period 250 consecutive patients underwent spinal instrumentation and fusion performed by the senior author (RP). These included those at the cervical (171), thoracic (34), and the lumbar (45) spinal levels. The indications were for trauma, degenerative changes, tumours, tuberculosis and congenital anomalies. The average follow up period was 1.1 years (3 months - 8 years). Of the 250 cases there was neurological deterioration observed in 6, in 4 there was root pain which recovered following removal of the pedicle screws. An intra op drop in SSEP was present in one patient which improved after removal of sub laminar wires and did not manifest as neurological deterioration post-op. There was an increased spasticity in 2 patients with Inter laminar clamps, who recovered following their removal. **Conclusions:** In experienced hands the neurological complications related to instrumentation is low. The infection rate can be kept to a minimum with meticulous technique. However its use should be confined to cases where clearly indicated.

Key words: Complications, Spine surgery, Instrumentation, Morbidity.

SPINAL instrumentation is primarily used to immobilize and stabilize the spine till bony fusion takes place. The secondary function is prevention of spinal deformity and alleviation of pain [1,3,4]. The common diseases in which these are used are spine trauma, degenerative disease, infections like Pott's spine, tumors and congenital anomalies. In our neurosurgical spine unit we have performed 250 spinal instrumentations between 1997 and 2004. This paper presents a retrospective analysis of the complications. We assessed morbidity in terms of failure of instrumentation, neurological worsening and infections which have been individually studied at the cervical and dorso-lumbar levels.

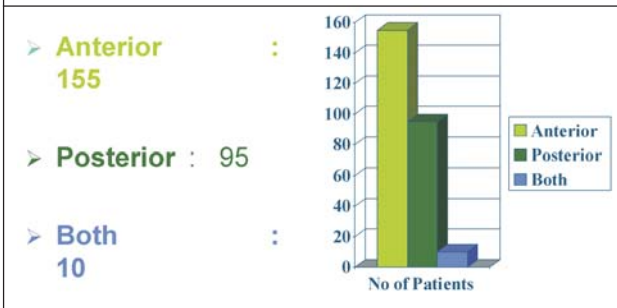
METHODS

Case records and imaging of 250 patients who had undergone spinal instrumentation between 1997 and 2004 , were examined. All patients except those with cervical disc disease, had varying degrees of spinal instability which required instrumentation.

There were 155 anterior procedures, 95 posterior procedures and 10 circumferential procedures (*Table* 1). Prophylactic antibiotics were utilised for all cases and we used Ceftriaxone and Amikacin for 48 hours peri-operatively. Oral antibiotics are then continued for a period of 5 days. Bone used for grafting was autologous from the site of surgery or iliac crest.

A halo vest has been used in 30 patients, to maintain a stable spine in the interim between diagnosis and surgery. In cases where following surgery a doubt about the degree of stability achieved with instrumentation arose halo vest was persisted post operatively for varying lengths of time. Our experience includes utilisation of this device for CV junction anomalies, rheumatoid disorders of the CV junction, cervical fracture/dislocations and post operatively as an adjunct to instrumentation.

Table 1: ***Location of Instrumentation.***



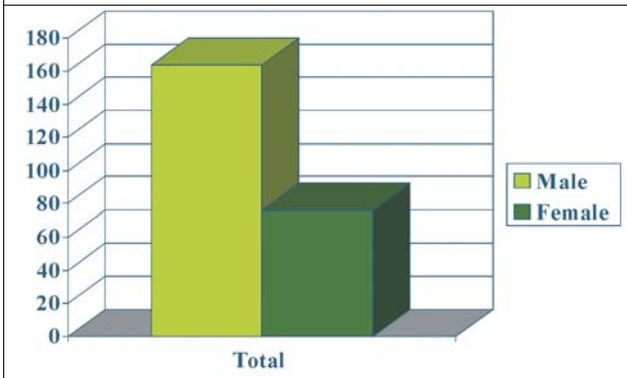
Follow up radiographs and clinical examinations were obtained subsequent to the procedures. Clinical symptoms and findings were documented at follow up. Further surgery, complications and further interventions were also noted.

RESULTS

The sex distribution is shown in *Table* 2. The age distribution was between 16 to 74 years with a mean of 34 years. The various pathologies for instrumentation are shown in *Table* 3.

The number of instrumentation procedures performed at each level is shown in *Table* 4. Of these the most performed procedure consisted of anterior cervical fusion with bone graft and plate, followed by the pedicle screw construct, and the remainder as shown in *Table* 5.

Table 2: *Sex ratio.*

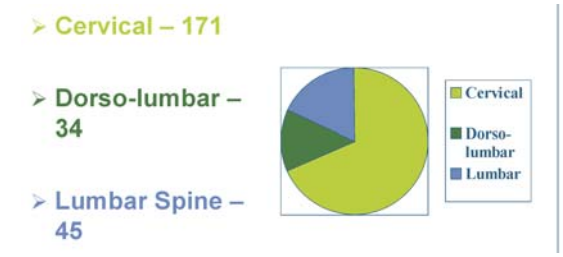


Male	:	170
Female	:	80

Table 3. *Etiology.*

Trauma	:	98
Degenerative	:	86
Tumour	:	26
Tb	:	20
Congenital	:	20

Table 4. *Instrumentation used.*



DISCUSSION

Major morbidity related to cervical spine surgery (*Table* 6) in the form of nerve and spinal cord injury is reported between 0.2 and 0.5% [2,10]. Oesophageal injuries are rare and seen in 1 in 500 cases [2,10]. The

Table 5. *Instrumentation used.*

Anterior cervical plate	-	147
Pedicle screw construct	-	65
Interbody cages	-	11
Inter-laminar clamps	-	06
Cervical lateral mass screws	-	04
Cervical miniplates	-	07
Titanium soft cable	-	14
Hartshill rectangle	-	07
Vertex Occ-cervical system	-	05

Table 6. *Morbidity related to 250 instrumentations.*

Infections		**2 cases**
Infection with ACP and oesophageal fistula	1	
Infection in thoracic spine gut shot wound with anterior screw/rod fusion	1	
Neurological worsening		**6**
Root apin	4	
Increased spasticity	2	
Implant failures		**8**
Cervical	5	
Thoracic	3	

Fig.1. C5-6 discectomy, bone grafting and fusion with plate and screws for disc disease.

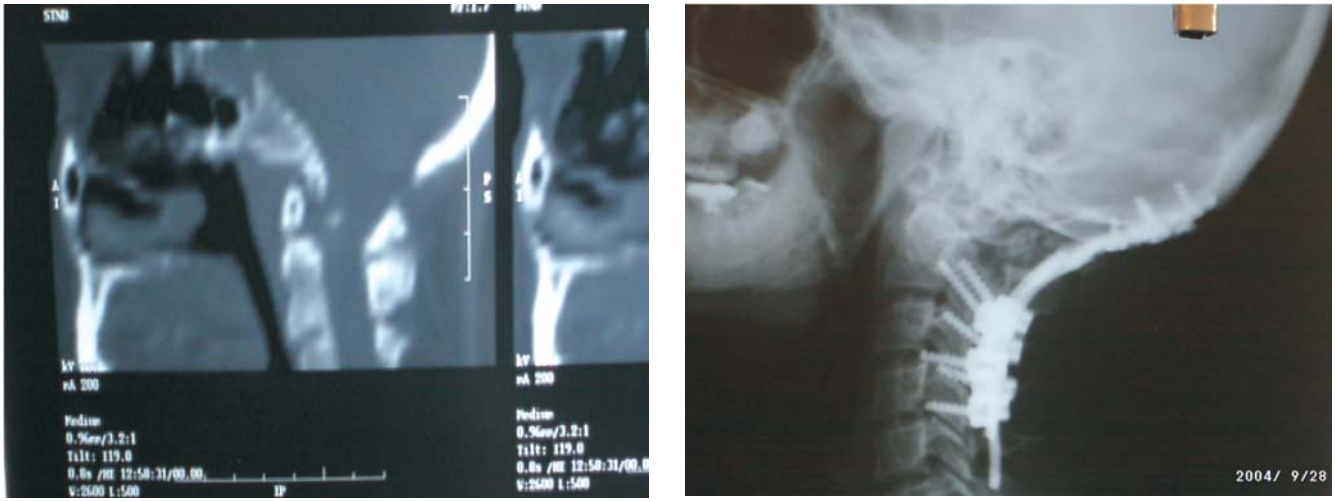


Fig. 2. A preop CT reconstructed image of the CV junction of a patient with an os odontoideum causing symptoms due to AAD. Along side a post operative X-ray after having undergone an occipeto-cervical posterior stabilisation.

Fig. 3. A post op circumferential fusion for spondylolisthesis.

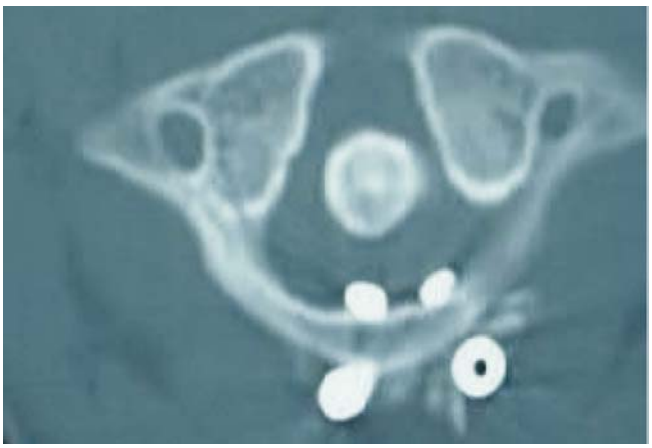


Fig. 4. A CT scan showing atlanto-axial re-dislocation post-op despite the clamps.

Fig. 5. Anterolateral screws to stabilise the dorsal spine fracture showing loosening of the rod after fusion.

infection rate related to cervical spine fusions is <1% and in our cases only 1/171 had developed an infection (0.6%). Implant failure occurred in 3 anterior cervical plates presenting as screw loosening, these were removed. These were our earlier cases of gross cervical instability treated with ACP alone. Subsequent cases have been held in a halo vest post-op for 6-12 weeks or reinforced with lateral mass plates. No further failures have occurred since.

Key Messages

- Cages can slip in cases where they are not supported by screws.
- Hartshill recangles can be dangerous in the cervical spine because of the sublaminar wiring which can cause cord/ dural compression by further compromising the canal diameter.
- If instrumentation is used in surgery of degenerative spinal disease, there should be minimal complications related to instrumentation.
- Meticulous technique aids in keeping the infection rate to a minimum.
- Use of spinal instrumentation should be confined to cases where clearly indicated.

2/171 patients presented with spasticity as a sign of their post op neurological worsening in these cases interlaminar C1-C2 clamps were used for AAD. These were removed. Intra op fixation with the Hartshill rectangle was abandoned due to a drop in the SSEP which improved after implant removal. So a total of 2/171 (1.2%) had transient neurological worsening as a result of cervical spine instrumentation. We have since abandoned the use of cervical interlaminar clamps. We make sure that ACP is only put after complete disc/osteophyte clearance thus preventing spinal cord injury.

At the thoracic level there were 3 cases in which the implant failed, 1 cage got displaced. In 2 cases the rods attached to antero-lateral screws loosened following fusion. There was one infection at this level, in a patient following a gun shot wound.

Lumbar spine fusions with pedicle screw constructs [2,8,11] have a reported infection rate between 2.2 and 7.5% and is assumed that very few surgeons with higher rates of infection publish figures. Neurological injury at this level is operator dependent and these often lie between 0-12% [2,5,9,11]. It is the experience of most operators that this incidence decreases with experience. Dural tears are seen to occur in 2.2 to 7.2% cases [5,7-9]. Steffee in his series reported a break in the neck region of the screws in 2.5%9.The incidence of fusion failure is between 0-9% [2,7-9]. Poor prognostic factors reported from literature are obesity, diabetes mellitus, continuing cigarette smoking, previous unsuccessful spinal operations. There were no infections in our series of pedicle screw constructs and no screw breakage or dural tears. There have been 45 pedicle screw constructs in this series in which 4 (8.9%) patients had root irritation syndrome for which the appropriate pedicle screw had to be removed.

The Committee for the survey of spine and spinal cord surgery [6], Japan Research Society, Tokyo, Japan, have published a nationwide survey on the complications of spine surgery in Japan . On 16157 patients enrolled from 196 institutes in one year, spinal instrumentation was used in 34% patients (5,497). Complications were reported in 1383 patients (8.6%) and the incidence of complications associated with instrumentation was 12.1%.

Complications associated with spine surgery can vary from 1 to 12% in various reported series. The complications are higher when instrumentation is used. In our series of instrumentations the complications were seen in 3.2% (8 out of 250 cases with 2 infections and 6 neurological worsening) which is well within the acceptable range. With careful case selection and meticulous technique this can be brought down further.

REFERENCES

1. Robert H Wilkins, Setti S Rengachary. Neurosurgery, 2nd edn.
2. Andrew H Kaye, Peter Mc L Black. Operative Neurosurgery.
3. Gertzbein SD, Betz R, Clements D, *et al.* Semirigid Instrumentation in the management of lumbar spinal conditions combined with circumferential fusion:A multi centre study. Spine 1996; 21(16): 1918-1925.
4. Holdsworth FW. Fractures, Dislocations and fracture-dislocations of the spine. J Bone and Joint Surgery (Br),1963; 45: 6.
5. Hsu J , Zukerman JF, White AH , Wynne G. Internal fixation with pedicle screws. *In:* White AH, Rothman RH, Roy CD, eds, Lumbar spine surgery. St. Louis, Mosby 1987; 32-33.
6. Nohara Y, Taneichi H, *et al*. Nationwide survey on complications of spine surgery in Japan. J Orthopedic Science 2004; 9(5): 424-433.
7. Larson SJ. The unstable spine. Orlando, Grune & Stratton, 1986; pp 127-152.
8. Larson SJ. Thoracolumbar trauma, ed. Clinical Neurosurgery. Baltimore, Williams & Wilkins,1993; pp 416-426.
9. Steffee AD, Brantigan JW. The variable screw placement spinal fixation system : Report of a prospective study of 250 patients enrolled in FDA clinical trial. Spine 1993; 18(9): 1160-1172.
10. Tew JJ, Mayfield F. Complications of surgery of the anterior cervical spine. Clin Neurosurgery 1976; 23(424): 424-434.
13. Zdeblick TA. A prospective randomised study of lumbar fusion: Preliminary results. Spine 1993; 18: 983-991.