Per-operative Instrument Failure in Lumbar Spine Surgery

Pokharel R K, Lakhey R B, Kafle D, Pokharel B, Dhakal R K, Sigdel A, Lalit T, Shah L L

Department of Orthopaedic and Trauma Surgery (Spine Unit), Institute of Medicine,

Maharajgunj Medical Campus, Tribhuvan University Teaching Hospital, Kathmandu, Nepal

Corresponding Author: Prof. Lakhan Lall Shah

Department of Orthopaedic and Trauma Surgery (Spine Unit)

Institute of Medicine, Maharajgunj Medical Campus, Tribhuvan University

Teaching Hospital, Kathmandu, Nepal

E-mail: llshah@iom.edu.np; llshah@healthnet.org.np

Abstract

Breakage of hardware is not an uncommon complication in spine surgery practice. Pedicle screw breakage is the commonest instrument failure encountered in spine surgery, and different relatively simple, techniques have been recommended to retrieve the threaded part of it. Per-operative breakage of an instrument like pedicle seeker and jaw of disc forceps is unpredictable and removal of an unthreaded smooth implant is difficult. We experienced breakage of the pedicle seeker while putting a pedicle screw in a case of spondylolisthesis and breakage of the mobile jaw of a disc forceps in another case of prolapsed intervertebral disc. Here we present an innovative technique of removal of the broken instrument through the pedicle. Regular maintenance and replacement of al old instrument is recommended.

Key words: per-operative instrument breakage, spine surgery

Introduction

There are relatively few reports on the management of broken implants such as nails, plates, screws, pins and wires in orthopaedic practice.[1,2] Similarly instrument failure in spine surgery is not uncommon[3] and there is relatively little information about this subject in the literature. We report two cases of instrument failures; and present an innovative technique of removal of broken pedicle seeker.

Case report

Case 1: An 18 years old girl presented to our out-patient clinic with low back pain and mild bilateral numbness in lower limbs without radicular pain. There was no history of trauma. Our diagnosis was dysplastic spondylolisthesis at L5 – S1 level based on clinical evaluation and radiographic imaging of the case. The spondylolisthesis was of grade three and it was considered there was risk of further progression. We advised surgical decompression, postero-lateral inter body fusion (PLIF), and postero-lateral fusion with instrumentation.

At operation, after successfully placing screws in the S1 pedicles, the left sided L5 pedicle was probed with a pedicle seeker. We do not use image intensification while inserting pedicle screws. While tapping the pedicle a metallic sound was noticed and the scrub nurse then noticed that the pedicle

seeker was broken. (figure 1)

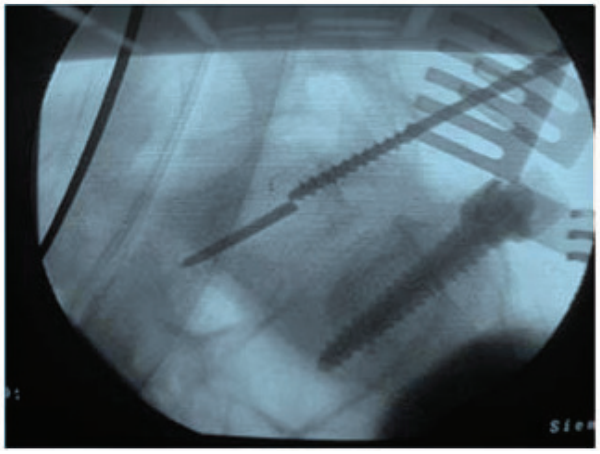

Figure 1. Lateral image showing broken piece of the pedicle seeker pushed forward by the pedicle tap.

A lateral radiographic image demonstrated that the broken tip of the pedicle seeker was retained within the L5 vertebral body and may have been further advanced during tapping of the pedicle. Various options to tackle this unexpected complication were considered. We thought of using an anterior transperitoneal approach with the help of a general surgeon to remove the broken piece of metal but decided to attempt removal of the metal object by widening the portal through pedicle and vertebral body. Various instruments were tried for removal of broken instrument without success until we finally used the "broken screw removal device" (figure 2) used to extract broken cortical screws.

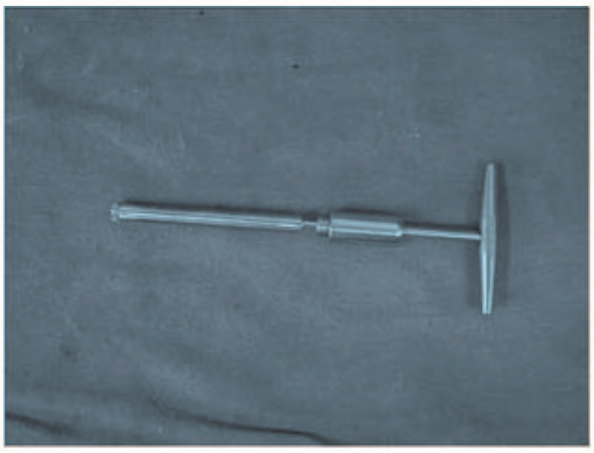

Figure 2. The broken screw removal device used to retrieve the broken metal piece.

Multiple cutting blades of the device were used to make a 6-8 mm diameter hole through the pedicle centering the broken end of the pedicle finder (figure 3). With the help of serrated disc forceps the piece of metal was grasped (figure 4) and pulled back up to the pedicular portal and taken out by an artery forceps. Removed piece of the pedicle finder was reassembled to confirm the size of the instrument.

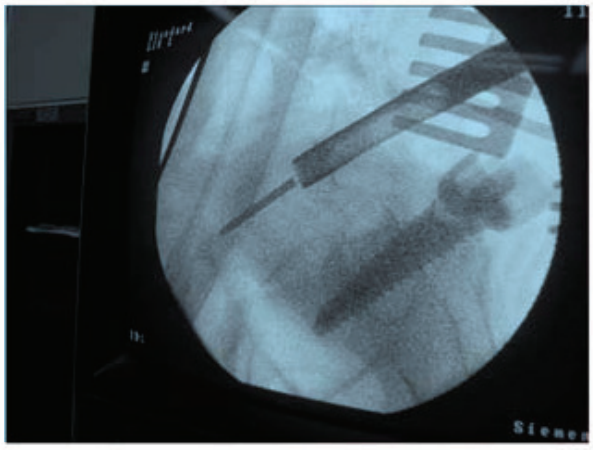

Figure 3. Lateral images recorded during transpedicular drilling with the broken screw extractor device centered on the end of the broken instrument.

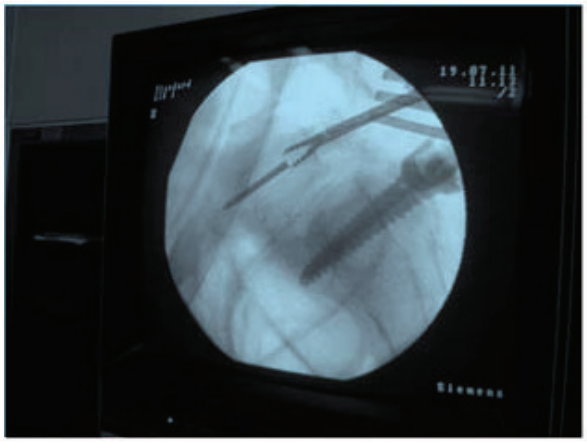

Figure 4. Lateral image showing use of disc forceps to remove retained metal.

As we had to make a large portal to accommodate the blades of the forceps we could not preserve the left side pedicle of L5 vertebrae for screw insertion. At this level the pedicle screw was put only in right side. However, the reduction of the listhesis was satisfactory. A small dural tear occurred at the level of S1 and this was successfully repaired. At two years since surgery the patient has made a satisfactory recovery.

Case 2: A 40 years old male patient presented to us with features of prolapsed inter-vertebral disc with left sided L5 root compression and was subjected for minimally invasive dissectomy. The sequestrated and offending part of the disc was removed in a single chunk. But while checking any small loose piece of disc, the mobile jaw of the disc forceps broke and remained in the disc space (figure 5). Under image intensifier the broken piece of the instrument was easily, after couple of try, taken out with the help of serrated disc forceps (figure 6). Whole instrument was reassembled to check the completeness of the forceps (figure 7).

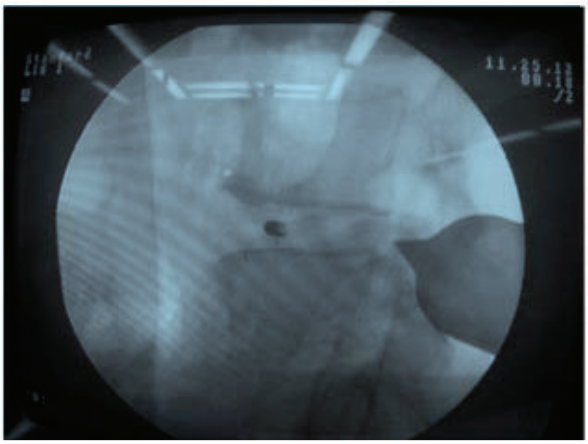

Figure 5. Lateral image showing broken jaw of the disc forceps.

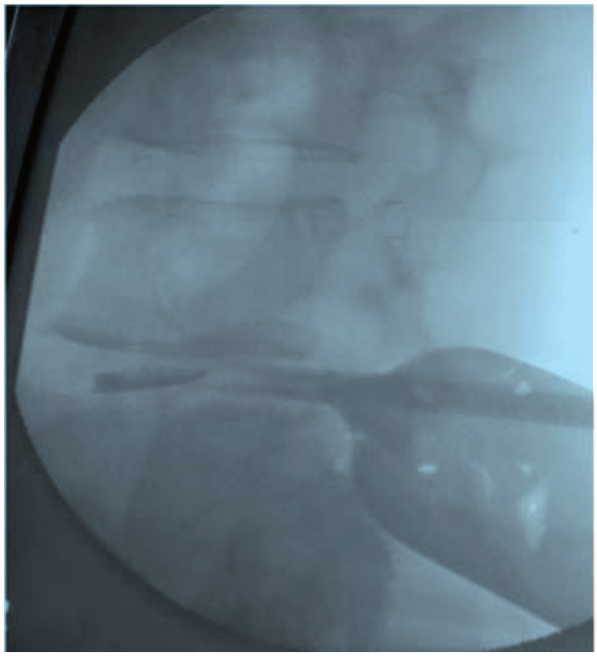

Figure 6. Lateral image showing attempt to remove the broken piece.

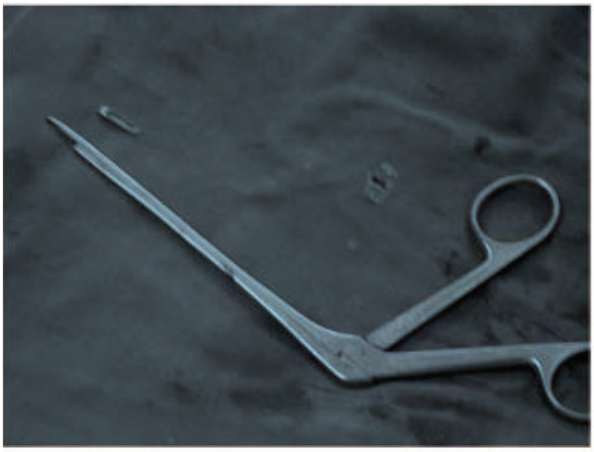

Figure 7. Photograph showing the disc forceps with broken blade.

Rest of the surgery went smooth and post operative period was uneventful and the recovery was excellent.

Discussion

Complex spine surgery is a relatively new discipline in developing countries. Surgical technology and instrumentation continue to develop with the goal of improving in the outcome of treatment of various spinal disorders. Transpedicular instrumentation which has been used widely for decades in much of the world[4] has now been embraced in a number of developing countries. Because of the inherent strength of pedicles, transpedicular instrumentation is the most common method of achieving short segment fixation and 3-dimensional correction.[5] Lumbar dissectomy is a commonly done surgical procedure and disc forceps is one of the important instrument for removal of disc.

Despite progressive improvement in metallurgy, there continue to be reports of failure of hardware (instruments and implants) used in spine surgery.[6] Repeated use of a metal tool may fail due to cyclic fatigue.[7] The incidence of implant failure in spine surgery is 3% to 7%,8 among which 25% is due to pedicle screw breakage.[3] There has been no report on breakage of instruments like pedicle seeker and/or blade of a disc forceps during operation. In our first case, breakage of a pedicle seeker occurred one centimeter below the junction of the rounded shaft and the beveled tip. Clearly this point of the instrument is subject to greater stress during repeated use. In the second case, the mobile blade or jaw of the disc forceps was broken at the hinged angle which is again a weak point for stress bearing. Though there was no record of the number of times the instruments were used, it had been in use for more than five years.

The removal of a retained broken piece of spinal hardware is often difficult and time consuming and no single technique is uniformly successful.[8] Preservation of the pedicle during and after removal of broken screw fragments may be challenging. There are numbers of techniques recommended to retrieve the broken piece of pedicle screws and most of the techniques are simple. Retrieving the threaded piece of a broken pedicle screw is achieved by making engage it with a removal instrument and twisting it anti-clock wise.[9-13] But removal of a smooth piece of a metal is rather difficult. Our experience highlights the difficulty in removing a smooth piece of metal such as a broken pedicle seeker. We were forced to make the tunnel larger to accommodate the disc forceps blades and were unable to preserve the pedicle of that level.

We have been unable to find any similar report in the spinal literature. However, the technique we employed was similar to that of Mitsukawa N[14] who used the screw extractor to remove a broken screw from the mandible and to Fauvell SA et.al who retrieved broken abutment gold screws from internally threaded endosseous implants.[15]

Per-operative complications are often unpredictable and difficult to tackle because of lack of preparedness. We hereby present a technique of removal of a pedicle seeker when it breaks during its use, and removal of the broken disc forceps was relatively easy. Regular checking of the instruments and replacement, if necessary, is recommended.

References

1. Pichler W, Mazzurana P, Clement H, Grechenig S, Mauschitz R, Grechenig W. Frequency of instrument breakage during orthopaedic procedures and its effects on patients. J Bone Joint Surg Am. 2008; 90: 2652-4.
2. Price MV, Molloy S, Solan MC, Sutton A, Ricketts DM. The rate of instrument breakage during orthopaedic procedures. Int Orthop. 2002; 26: 185-7.
3. Esses SI, Sachs BL, Dreyzin V. Complications associated with the technique of pedicle screw fixation. A selected survey of ABS members. Spine. 1993; 8:2231–2239.
4. Boos N, Webb JK. Pedicle screw fixation in spinal disorders: a European view. Eur spine J. 1997; 6:2–18.
5. Morgan JM, Berg WS, Berry JL, et al. Transpedicular screw fixation. J Orthop Res. 1989; 7: 107–114.
6. Hak DJ, McElvany M. Removal of broken hardware. J Am Acad Orthop Surg. 2008; 16:113-20.
7. Plotino G, Grande NM, Cordaro M, Testarelli L, Gambarini G. A review of cyclic fatigue testing of nickel-titanium rotary instruments. J Endod. 2009; 35:1469-76.
8. Brown CA, Eimont FJ. Complications in spinal fusion. Orthop Clin North Am. 1998; 29:679–699.
9. Weng Xisheng; Qiu Guixing; Li Junwei; Li Shugang; Lee Chia-I; Yu Bin; Li Lianhua. An Innovative Broken Pedicle Screw Retrieval Instrument. J Spinal Disord Tech. 2007; 20:82-84.
10. Kaya AH, Dagcinar A, Celik F, Senel A. Simple technique for removing broken pedicular screw with plain and serviceable screwdriver. Eur Spine J. 2008; 17:1116-8.
11. Di Lorenzo N, Conti R, Romoli S. Retrieval of broken pedicle screws by "friction" technique. Technical note. J Neurosurg. 2000; 92:114-6.
12. Miyamoto K, Shimizu K, Kouda K, Hosoe H. Removal of broken pedicle screws. J Neurosurg. 2001; 95:150-1.
13. Duncan JD, MacDonald JD. Extraction of broken pedicle screws: technical note. Neurosurgery. 1998; 42:1399-400.
14. Mitsukawa N. Clinical experience with the screw extraction set for broken screw. J Craniofac Surg. 2011;22(1):226-9.
15. Fauvell SA, Gialanella G, Penna KJ. The Lumen Technique. Retrieval of broken gold screws in dental implants. N Y State Dent J. 2006; 72:43.