

Technical advance

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Multiple parallel skin markers for minimal incision lumbar disc surgery; a technical note

Kai-Jow Tsai¹, Shih-Hao Chen² and Po-Quang Chen^{*3}

Address: ¹Department of Orthopedic Surgery, Cathay General Hospital, Taipei, Taiwan, ²Department of Orthopedic Surgery, Chang-Gung Memorial hospital, Taipei, Taiwan and ³Department of Orthopedic Surgery, National Taiwan University Hospital, Taipei, Taiwan

Email: Kai-Jow Tsai - tsaijk@ms2.hinet.net; Shih-Hao Chen - shihhao@adm.cgmh.org.tw; Po-Quang Chen* - pqchen@ccms.ntu.edu.tw

* Corresponding author

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Abstract

Background: Spinal surgery depends on accurate localization to prevent incorrect surgical approaches. The trend towards minimally invasive surgery that minimizes surgical exposure and reduces postoperative pain increasingly requires surgeons to accurately determine the operative level before an incision is made. Preoperative localization with a C-arm image intensifier is popular, but the exposure of both patients and theatre staff to radiation is a disadvantage, as well as being time-consuming.

Methods: We describe a simple surgical tool developed to help localize exact spinal levels in conjunction with a simple AP X-ray film immediately before surgery. Multiple parallel skin markers were made using a circular oven rack comprising multiple 1.5 cm spaced parallel wires attached to a circular outside rim. The longest line was placed on the line of the postero-superior iliac spine (PSIS) over the junction of the L5-S1 region.

Results and conclusions: Based on the film taken, the incision can be accurately made at the intended level. The incision wound can be minimized to 3.0 cm even when using conventional disc surgery instruments.

Background

Lumbar disc surgery is one of the most common procedures in spinal surgery that was discovered by Mixter and Barr in 1934 [1], and selecting the correct level for the skin incision is critical. The conventional method of localizing the correct level is palpation of the spinous processes of the lumbar spine and iliac crests [2,3]. This technique is difficult in obese patients who may require a longer skin incision so that the fascia and muscle layers can be opened. The surgeon can then confirm the exact level for the discectomy by palpation and movement of the fifth lumbar vertebra rather than the motionless sacrum. A clip is sometimes necessary to identify the correct level after radiographic confirmation during anesthesia. The con-

ventional approach usually requires a wound 5 to 10 centimeters in length. An intraoperative lateral view of the lumbar spine is then made by permanent film or fluoroscopically to confirm the level of the intended discectomy, adding to the radiation exposure of both theatre staff and the patient.

In this article, a new technique is described that can help to minimize the skin incision required by more simply and effectively identifying the correct spinal level.

Methods

Under general anesthesia, the patient is evenly placed in a prone position on the frame, suspending the abdomen to

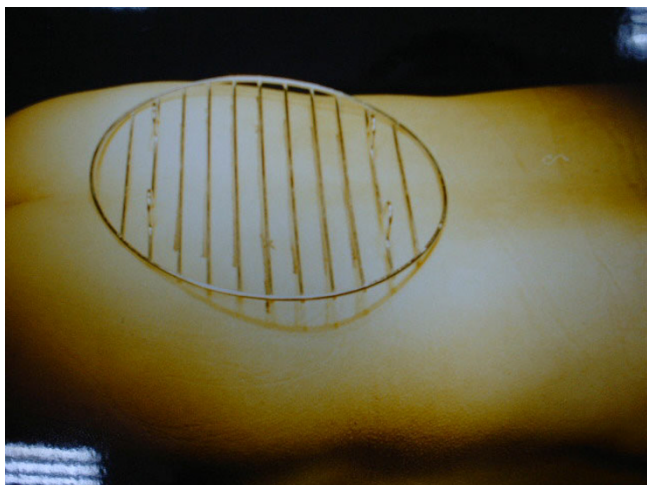


Figure 1
A circular oven rack is placed over the surgical field.



Figure 3
The PA lumbar film shows the correct lumbar spine level.

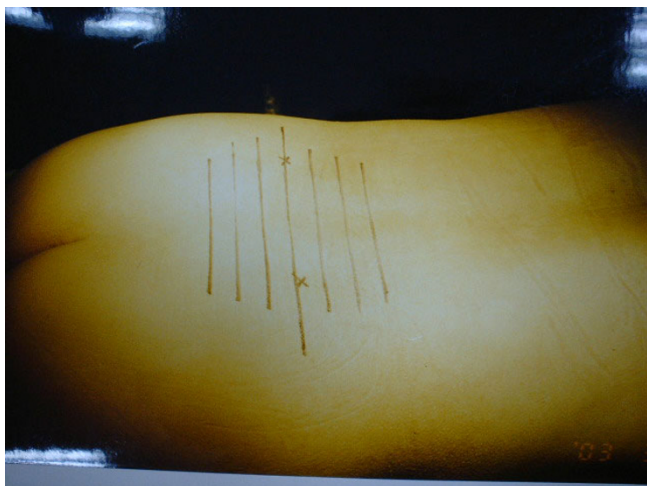


Figure 2
Multiple parallel lines are drawn on the skin along the parallel wires of the oven rack with a permanent marker pencil.

relieve abdominal pressure. The posterior superior iliac spines (PSIS) are palpated and lines drawn to connect both PSIS's with a permanent marker pencil. This line is supposed to pass between L5 and S1. A circular oven rack is then placed on the surgical field (Fig. 1). A preoperative permanent posterior-anterior (PA) film is then taken. Multiple parallel lines are then drawn on the skin along the 1.5 cm spaced parallel wires of the oven rack with the permanent marker pencil (Fig. 2). The surgical field is then disinfected and draped. The PA film of the lumbar

spine allows the correct level of the lumbar spine to be determined simply by counting the lines until the desired disc space is reached (Fig. 3). A small incision is then made.

Results

Usually, a 3 cm incision is needed for one-level disectomy (Fig. 4). The fascia is incised at the midline using electrocautery, and a periosteal elevator is inserted in the midline incision. Using gentle lateral movements, the deep fascia and muscle is subperiosteally separated from the spinous processes and lamina. Meticulous electrocautery is needed to minimize bleeding. A finger is then inserted to allow palpation of the interlaminar space. If necessary, bayonet forceps are placed in the interlaminar space and a permanent lateral view is again taken to confirm the level before performing the disectomy.

Discussion

Conventional lumbar disc surgery as described in textbooks employs a midline incision 5 to 10 cm in length from the spinous process of L4 to S1 [2]. The level of the iliac crest revealed by the plain film of lumbar spine was used to determine the spinous process of L4 [3]. The surgeon exposes the interspaces under direct vision so that no mistake is made while exploring the interspaces. The fascia, tendon and muscles are sacrificed in these procedures. The disc surgery itself involves decompression of the nerve root to relieve pain. If too much soft tissue and bone is damaged, post-operative pain is inevitable. Lumbodorsal fascia injury also leads to postoperative pain and can limit the back's range of motion postoperatively.

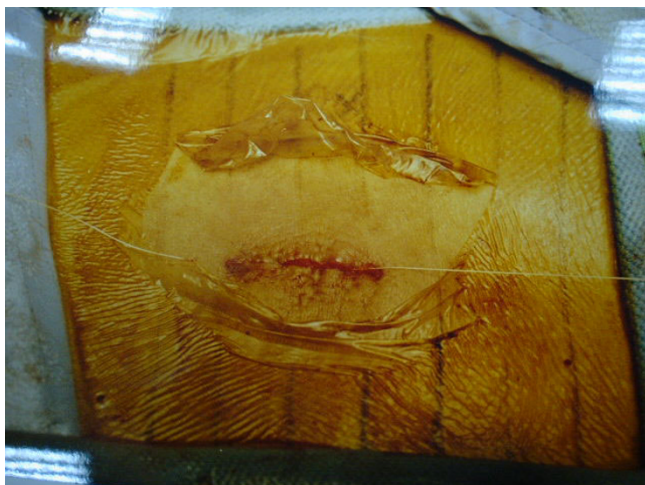


Figure 4
A 3 cm incision is needed for one-level discectomy.

The micro lumbar discectomy was developed in order to minimize injury to the musculature of the back. An operative microscope is used for better visualization and special retractors and miniature instruments are used for the discectomy itself [4]. Curettage of the disc space is not mandatory. The use of the microscope can lead to loss of three-dimensional visualization and introduces another potential source of operative field contamination. The preoperative localization of the surgical level is made with spinal needles [5,6]. Two #20 gauze spinal needles are inserted perpendicularly to the skin approximately three-finger widths lateral to the spine, and lateral skin marker radiographs are then obtained. The skin incision is then made midline over the disc space. The paraspinous needles allow more accurate skin incision placement than a spinous process marker. The disadvantages are that spinal needle insertion may increase the risk of infection, and that it is a time-consuming procedure.

The arthroscopic micro discectomy was introduced by Kambin and colleagues [7,8]. An 8 mm internal diameter cannula is introduced into the triangular working zone. Intraoperative fluoroscopic images are used to navigate the position of an oval cannula in these zones between the traversing and exiting nerve roots at the dorso-lateral aspect of the intervertebral disc. The percutaneous nucleotomy was described by Hijikata. In the procedures, the fluoroscopic image control is indispensable to confirm and document disc penetration and to watch the annulus cutter does not go too far to the other margin [9,10]. The continuous exposure of theatre staff and the patient to x-ray radiation is the chief concern with this technique.

The minimal access surgery for the anterior lumbar spine fusion described by Huang and colleagues [11]. The techniques to localize the exact disc level was approached with the aid of C-arm intensified in an anteroposterior (AP) direction. Then an intersection point formed by the kirschner wire and the extension line of the anterior axillary line of the patient was marked. With this method, the need for radiologic check in a lateral direction was circumvented. The confirmation was obtained by a C-arm intensifier during the operation. Miccoli and colleagues developed minimally invasive video-assisted approach to the cervical spine. They inserted a 1-mm metal probe to exactly localize during fluoroscopy the vertebrae reached by the dissection for the anatomic-radiologic study [12]. In these procedures, the preoperative localization was performed by fluoroscopy and the exposure to radiation of surgeons and patients is inevitable.

The currently described procedure produces multiple parallel skin markers that correspond to the PA view of the patient positioned on the operating table. The patient needs to be placed evenly on the table to prevent differences arising with movement between the skin markers and interspaces of the lumbar spine. The intraoperative lateral radiograph is essential for confirmation of the level before laminectomy.

Conclusions

The presently described technique has the advantages of simplicity, being non-invasive to the surgical field, low cost and a straightforward posterior approach to the spine which does not need to depend on spinous process palpation or additional lateral radiographs. The PA radiograph with parallel wires enables the correct level of the lumbar spine to be counted from the film and skin markers and the incision to be centered to the disc space using just the PA radiograph, helping to minimize the size of the required incision and exposure to radiation. One final benefit of the technique is that it can also be used as an aid for endoscopic or micro-discectomy surgery.

Abbreviations

PSIS: posterior superior iliac spine

PA: posteroanterior

Competing interests

None declared.

Authors' contributions

KJT: original idea of this paper and paper writing

SHC: paper writing advice.

PQC: paper writing revision, supervisor.

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