

Use of Alexis[®] Retractor in Anterior Lumbar Interbody Fusion: First Experiences at a Single Center

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Abstract

INTRODUCTION

Retroperitoneal approach for Anterior Lumbar Spine Fusion (ALIF) surgery is a widespread approach used in lumbar surgery. It normally requires the use of metallic retractors fixed to the operative table. The friction between the blades and the soft tissues can produce injuries. In this study, we present the initial experience of ALIF surgeries performed with the Alexis retractor, a self-holding retractor made of 2 stiff plastic rings joined by a cylindrical reinforced polyurethane sheath that provides 360° circular retraction. We believe that its use could provide an excellent exposure and allow an atraumatic retraction in Mini-invasive ALIF.

METHODS

We present a case series of 11 patients who underwent an anterior approach using the Alexis plastic ring wound retractor. In all cases, a mini-invasive pararectal and retroperitoneal approach was performed. Demographic and clinical data, complications and the surgeon's experience were collected.

RESULTS

The cohort included 8 female and 3 males (BMI: 27.0, Mean age: 50.2y.o). Three patients had previous abdominal surgery. For all the patients, the retractor provided a great exposure with a minimum incision size (6-7cm). We obtained an excellent visualization of the great vessels and the lumbar disc in a mini-invasive way. Moreover, we had less tissue handling with no interference from prolapsing bowel. The peritoneal sac was perfectly contained by the inner ring and the cylindrical sheath. We didn't have to coagulate the subcutaneous fat and didn't observe skin lacerations. No complications related to the retractor were reported.

CONCLUSIONS

Alexis retractor is a useful and safe retractor that can help to perform a mini-invasive anterior approach for ALIF. It provides a great exposure and an unobstructed view of the working area. It offers a low profile, radiolucent 360° atraumatic retraction. In this series, no complications related to the retractor were described.

Level of Evidence: IV

Introduction:

Retroperitoneal approach for Anterior Lumbar Spine Fusion (ALIF) surgery is a widespread approach used in lumbar surgery. It has proved useful for a huge variety of indications in the degenerative lumbar spine: spondylolisthesis, degenerative disc disease, adjacent segment disease, deformities, etc.

ALIF indications are rising[1–4] and compared to posterior approaches, anterior retroperitoneal approaches present unique advantages[2]. However, they also present unique difficulties: the peritoneal sac must be moved aside and the great vessels need to be retracted to allow a good exposure of the lumbar intervertebral discs. The development of mini-invasive surgery (MIS) allows smaller incisions but require greater protection of soft tissues.

ALIF requires the use of metallic retractors, often fixed to the operative table. Many of them are metallic rings on which different blades can be fixed. These retractors are expensive and the friction between the blades and the skin or the soft tissues can be a drawback.

The Alexis plastic ring wound retractor (Applied Medical, Rancho Santa Margarita, California, USA) is a self-holding retractor used in open procedures to optimize abdominal visualization that provides 360° circular retraction. Its use is increasing in abdominal surgery and many authors report that it facilitates the access to the abdominal cavity, particularly during MIS.

It consists of 2 stiff plastic rings joined by a cylindrical reinforced polyurethane sheath. The outer ring lies externally on the outside of the abdomen protecting the wound edges. The soft inner ring is flexible and is placed in the abdomen cavity. It has been designed to act as a form of barrier protection and provides an uniform force distribution throughout the wound in a more atraumatic way than traditional retractors. We believe that the use of this type of retractor could provide an excellent exposure and allow an atraumatic retraction in anterior approach of the lumbar spine.

In this study, we present the initial experience of ALIF surgeries performed with the Alexis retractor. To our knowledge, this is the first study reporting the use of Alexis retractor in ALIF.

Material And Methods:

We present a case series of 11 patients who underwent an anterior approach for anterior lumbar interbody fusion using the Alexis plastic ring wound retractor. In all cases, a mini-invasive pararectal and retroperitoneal approach was performed.

Demographic (age, gender) and clinical data (body mass index, surgery indication, length of stay and surgical history) were collected. Any complications of the surgery, related or not to the retractor, were reported. Finally, the surgeon's experience in terms of exposure, use easiness and quality of the working space was described.

Surgical technique: left pararectal and retroperitoneal approach.

In all cases, a vascular and orthopedic surgeons were responsible for the surgery. Informed consent was given for surgery. General anesthesia and preoperative antibiotics were administered as per anesthesia protocol. The patients were placed in supine position with legs open. The access surgeon was positioned between the legs of the patient. Once sterile preparation and drape of the abdomen were performed, timeout was completed.

We performed a left pararectal and retroperitoneal approach (Figure 1). The incision for L5-S1 is usually placed at the junction of the lower and middle thirds of the distance between the umbilicus and the symphysis pubis. We realized a 7 cm Pfannenstiel incision that began at the midline and was carried transversely to the lateral edge of the rectus muscle. After division of the subcutaneous tissue, the fascia of the rectus muscle was exposed. The alba line was identified and a longitudinal incision of the fascia 0.5 cm parallel to this reference was performed. A gentle mobilization and lateral retraction of the rectus muscle allows the access to the abdominal cavity. In most cases, the Arcuate line of the rectus sheath was identified. Posteriorly, with blunt finger dissection and then pushing medially to elevate the peritoneum away from the psoas muscle, the retroperitoneal space was entered. Then, the left iliac artery and the ureter were identified and protected. At this moment, the Alexis was placed, improving immediately the exposure, and protecting the peritoneal sac. The iliac vein was identified and protected and the L5-S1 disc was localized. The sacral artery and sacral veins were cauterized or ligated in most of the cases to provide a clear access to the disc. The approach was completed with the placement of two medial valves fixed respectively through a metallic pin to the S1 and L5 bodies. Once the approach was completed and the working space prepared (figure 2), the disc and the cartilage of the endplates were removed for the placement of the cage and plate.

Results:

We present a series of 11 patients who underwent ALIF with a retroperitoneal anterior approach using the Alexis retractor (Figure 3). The mean age of the patients was 50.2 years old, and the cohort included 8 female and 3 males. The mean BMI was 27.0 (see table 1). 3 patients had previous abdominal surgery. 8 patients underwent surgery for an isthmic spondylolisthesis Grade I or II, 1 for the treatment of a fractional curve in a lumbar scoliosis, 1 for a pseudarthrosis at L5-S1 and 1 patient for severe discopathy (see table 1).

Our experience with the retractor exceeds our expectations. The retractor was easy to apply and easy to remove. It was useful providing a great exposure with a minimum incision size (6-7cm). We obtained an excellent visualization of the great vessels and the lumbar disc in a very mini-invasive way. Moreover, we had less tissue handling with no interference from prolapsing bowel. The peritoneal sac was perfectly contained by the inner ring and the cylindrical sheath. We didn't have to coagulate the subcutaneous fat and we didn't observe skin lacerations.

We did not report any complications related to the retractor. We had no infection, and its use was safe. We experienced two intraoperative complications related to the anterior approach but with no relation with the retractor:

In the first case, the peritoneum was opened incidentally before placing the retractor. It was closed immediately with two sutures. In our patient number 4, the bifurcation was low, and the left iliac vein was positioned in front of the lumbar disc. During the preparation of the disc the vein was injured with a scalpel. The bleeding was controlled applying a gentle pressure on the vein and was repaired with three

surgical stitches of 5/0 monofilament. The visualization and control of the vessel proves to be sufficient, and the complication was perfectly managed without the need to increase the exposure.

All patients were discharged early with a medium length of stay of 2,5 days.

Discussion:

A correct indication and appropriate surgical planning are basic to perform a successful surgery. Mini-invasive ALIF is gaining popularity among spine surgeons, with increasing indications[2, 3] and well-defined advantages[1, 5]. It allows an early recovery and given its unique morbidity profile, it rises high expectations.

The “perfect retractor” in anterior lumbar fusion should offer a good exposure of the retroperitoneal space, the discs and the vessels while being easy to use. It should provide a clear access to the disc and in case of injuries, an adequate working space to face a complication like the repair of a vessel. It should also maintain an effective retraction of soft tissue during the entire surgery, avoiding injuries to the skin, subcutaneous tissue, visceral organs, genitourinary system, and it should not interfere with fluoroscopy.

In most cases, spine surgeons use metallic retractors consisting of ring systems in which many blades can be fixed in different locations and variable depths. These retractors require articulating arms to be attached to the operative table, more precisely on the drapes (with a theoretical risk of infection), which increase the time of the set up compared to self-retaining retractors. The metallic retractors can potentially produce tension to the skin and to the peritoneal sac, they increase the risk of thermal injury with the use of electrocautery, are expensive and interfere with radioscopy.

Our experience with the Alexis retractor in this series of L5-S1 mini-invasive ALIF is extremely positive. In all cases, by maximizing the visualization with a minimum incision, the use of a plastic-sheath wound retractor provides a great exposure and an unobstructed view of the working area throughout the whole procedure. It offers a low profile, radiolucent 360° atraumatic retraction.

ALEXIS is considered a wound protector since the tissue retraction is soft, atraumatic, and distributed along the 360° of circumference. It avoids trauma or pain related to an inappropriate pressure at a specific localization. In fact, many authors highlight its role as a wound protector and a huge experience with its use has been reported in very different surgical fields: cystectomy[6], shunt surgery[7], cesarean section[8], appendectomy[9], colorectal resections[10], thyroid surgery[11] etc..

In our series, we didn't report injuries to the soft tissues or the skin. In the retroperitoneal approaches, the specific design of the Alexis retractor enables one to move the peritoneum below the plastic sheath tensed between the two rings retractors. This minimizes the risk of injury to the alimentary tract. Moreover, the plastic cylinder lies firmly in contact with the surrounding tissues, protecting the entire wound and the skin during the whole surgery.

Although the reported rate of infection in ALIF is already low[1, 5, 12] (0.6–2.3%), the Alexis retractor may play a role to reduce even further the risk of Surgical Site Infections (SSI).

SSI is one of the major complications of spinal surgery, leading to increased length of stay, high health related cost, complex revisions surgery, emotional distress for patients and risk of needing intensive care or increased mortality.

In other specialties, a growing amount of evidence with high quality studies including several Randomized Clinical Trials[9, 10, 13–16] (RCT) has shown a decrease of the infection rate with the use of plastic self-retaining retractors. In three different RCT, Horiuchi[15], Cheng[13] and Reid[10] have shown that the use of the Alexis wound retractor decreases the rate of infection in colorectal surgery. Hinkson[8] et al have shown similar results for C-section in another prospective, randomized, controlled study. Moreover, in a systematic review of 16 randomized controlled trials including 3695 patients, Mihaljevic et al[16] concludes that circular wound edge protectors significantly reduce the rate of surgical site infections in open abdominal surgery.

The underlying theory is that ALEXIS creates a physical barrier between the wound edges and the surgical working area, protecting the wound from bacterial contamination[9]. In our series, no infections have been reported but we are aware that a much bigger cohort would be necessary to provide evidence of SSI decrease.

Another potential advantage of ALEXIS is the tamponade effect to minimize blood loss[8] considering that transfusion requirement is one of the most common medical complications⁵. As described by Hinkson[8], the use of the retractor would aid in the reduction of subcutaneous bleeding, providing better hemostasis and reducing the need for electrocautery.

Compared to manual retraction, self-retaining retractors also present other noticeable advantages. They decrease the risk of musculoskeletal disorders in surgeons, provide hands-free long lasting and stable retraction and reduce strain, discomfort and fatigue associated with traditional hand-held retractors[17].

Finally, compared to the cost of metallic retractors, the Alexis retractor is really unexpensive (60€ per unit in our hospital). Due to the short length of stay of MIS ALIF (3.6 days), ALEXIS would fit perfectly in Early Recovery After surgery (ERAs) protocols.

Conclusion:

Alexis retractor is a useful and safe retractor that can help to perform a mini-invasive anterior approach for ALIF. In this series, no complications related to the retractor were described and its use provided a great exposure and an adequate working space to perform an anterior lumbar fusion. In our opinion, it also presents some advantages compared to metallic retractors. We warmly recommend its use.

Declarations:

1. Funding (information that explains whether and by whom the research was supported)

This study has not received any financial support.

There is no financial support that could have influenced the outcome of this work.

2. Conflicts of interest/Competing interests (include appropriate disclosures)

No conflicts of interest are associated with this publication.

3. Ethics approval (include appropriate approvals or waivers)

The study was performed with the approval of the ethics committee (Comité de ética de la investigación: CEIM/CEI Provincial de Granada). Patients were enrolled after obtaining proper consent through an Institutional Review Board (IRB)-approved protocol 1786-N-21.

4. Consent to participate (include appropriate statements)

Informed consent was obtained from all participants.

5. Written Consent for publication (include appropriate statements)

We declare that this manuscript is original and has not been published and is not currently being considered for publication elsewhere. All the authors have given their consent for publication.

6. Availability of data and material (data transparency)

All the data, material are available if required.

7. Code availability (software application or custom code)

Not applicable

8. Authors' contributions

- Author A, Author B, Author C and Author D designed the study.
- Author A, Author B, Author C, Author D and Author E performed the experiments and analyzed the data.
- Author A, Author B, Author C, Author D and Author E provided critical reagents.
- Author A, Author F and Author G supervised the experiments.

As the Corresponding Author, I confirm that the manuscript has been read and approved for submission by all the named authors.

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Conflicts of interest in this manuscript

None declared

Relationships of the authors with organization and entities are summarized below:

None are related to the present manuscript

- Dr. Nicolas Plais is a consultant for Medtronic and report stocks in Spinewave.

For the remaining authors, none were declared.

COI statements have been included in the submission.

Ethics

Patients were enrolled after obtaining proper consent through an Institutional Review Board (IRB)-approved protocol 1786-N-21 (Portal de Etica de la Investigación Biomédica de Andalucía). The study was performed with the approval of the ethics committee.

Informed consent was obtained from all participants.

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Tables:

Table 1: Demographic and clinical data

	Age	Gender	BMI	Diagnosis	Procedure
<i>Patient 1</i>	55	Male	27,1	<i>Isthmic spondylolisthesis Grade I</i>	<i>ALIF L5-S1 Standalone</i>
<i>Patient 2</i>	41	Female	24,5	<i>Isthmic spondylolisthesis Grade I</i>	<i>ALIF L5-S1 Standalone</i>
<i>Patient 3</i>	69	Female	26,2	<i>Scoliosis with fractional curve</i>	<i>ALIF L5-S1 and posterior fusion</i>
<i>Patient 4</i>	50	Male	24,5	<i>Severe discopathy with foraminal stenosis</i>	<i>ALIF L5-S1 Standalone</i>
<i>Patient 5</i>	39	Female	32,5	<i>Isthmic spondylolisthesis Grade I</i>	<i>ALIF L5-S1 Standalone</i>
<i>Patient 6</i>	45	Female	26,08	<i>Isthmic spondylolisthesis Grade II</i>	<i>ALIF L5-S1 Standalone</i>
<i>Patient 7</i>	44	Female	32,8	<i>Isthmic spondylolisthesis Grade I</i>	<i>ALIF L5-S1 Standalone</i>
<i>Patient 8</i>	63	Male	32,7	<i>Pseudarthrosis L5-S1 after posterior fusion and implant removal</i>	<i>ALIF L5-S1 Standalone</i>
<i>Patient 9</i>	49	Female	26,9	<i>Isthmic spondylolisthesis Grade II</i>	<i>ALIF L5-S1 Standalone</i>
<i>Patient 10</i>	52	Female	21,5	<i>Isthmic spondylolisthesis Grade I</i>	<i>ALIF L5-S1 Standalone</i>
<i>Patient 11</i>	45	Female	22,6	<i>Isthmic spondylolisthesis Grade I</i>	<i>ALIF L5-S1 Standalone</i>

BMI: Body Mass Index

Table 2: Complications and treatment

	<i>Anterior abdominal surgery</i>	<i>Complications</i>	<i>Treatment</i>	<i>Length of stay (days)</i>
<i>Patient 1</i>	<i>No</i>	<i>Incidental opening of peritoneum</i>	<i>inmediate closure</i>	<i>4</i>
<i>Patient 2</i>	<i>C-section</i>	<i>-</i>		<i>4</i>
<i>Patient 3</i>	<i>Yes. Appendectomy</i>	<i>-</i>		<i>7</i>
<i>Patient 4</i>	<i>No</i>	<i>Lumbar iliac vein injury.</i>	<i>Inmediate repair with sutures</i>	<i>3</i>
<i>Patient 5</i>	<i>No</i>	<i>-</i>		<i>3</i>
<i>Patient 6</i>	<i>Yes. C-section</i>	<i>Superficial seroma.</i>	<i>Antibiotics and follow-up</i>	<i>4</i>
<i>Patient 7</i>	<i>No</i>	<i>-</i>		<i>3</i>
<i>Patient 8</i>	<i>No</i>	<i>-</i>		<i>3</i>
<i>Patient 9</i>	<i>No</i>	<i>-</i>		<i>3</i>
<i>Patient 10</i>	<i>No</i>	<i>-</i>		<i>3</i>
<i>Patient 10</i>	<i>No</i>	<i>-</i>		<i>3</i>

Figures

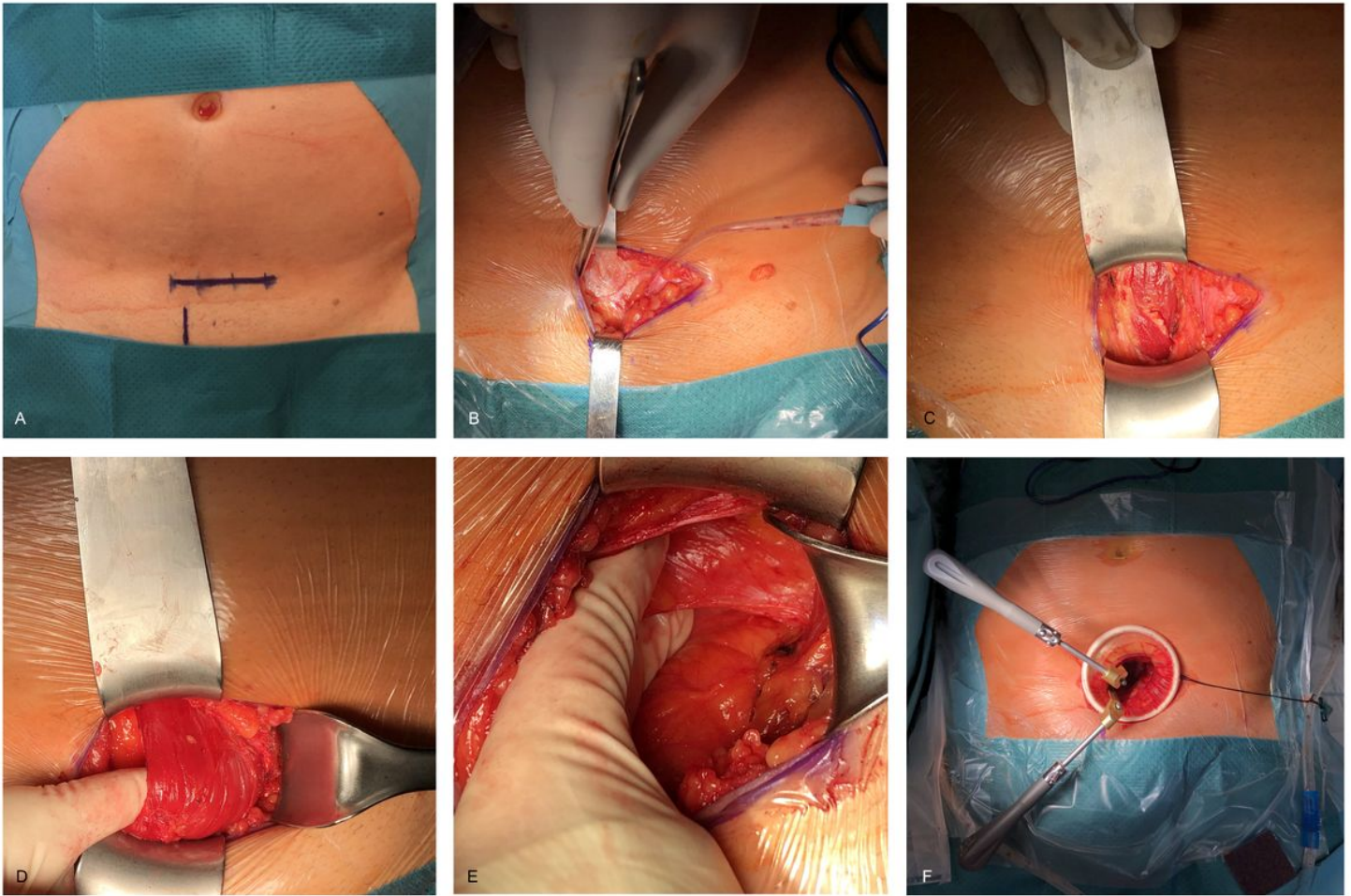


Figure 1

Mini-invasive pararectal and retroperitoneal approach. 1-a: Incision; 1-b: Exposure of the rectus fascia. 1-c: Longitudinal Incision parallel to the alba line. 1-d: Lateral mobilization of the rectus abdominis muscle. 1-e: Identification of the Arcuate line. 1-f: Placement of the Alexis retractor and two valves.

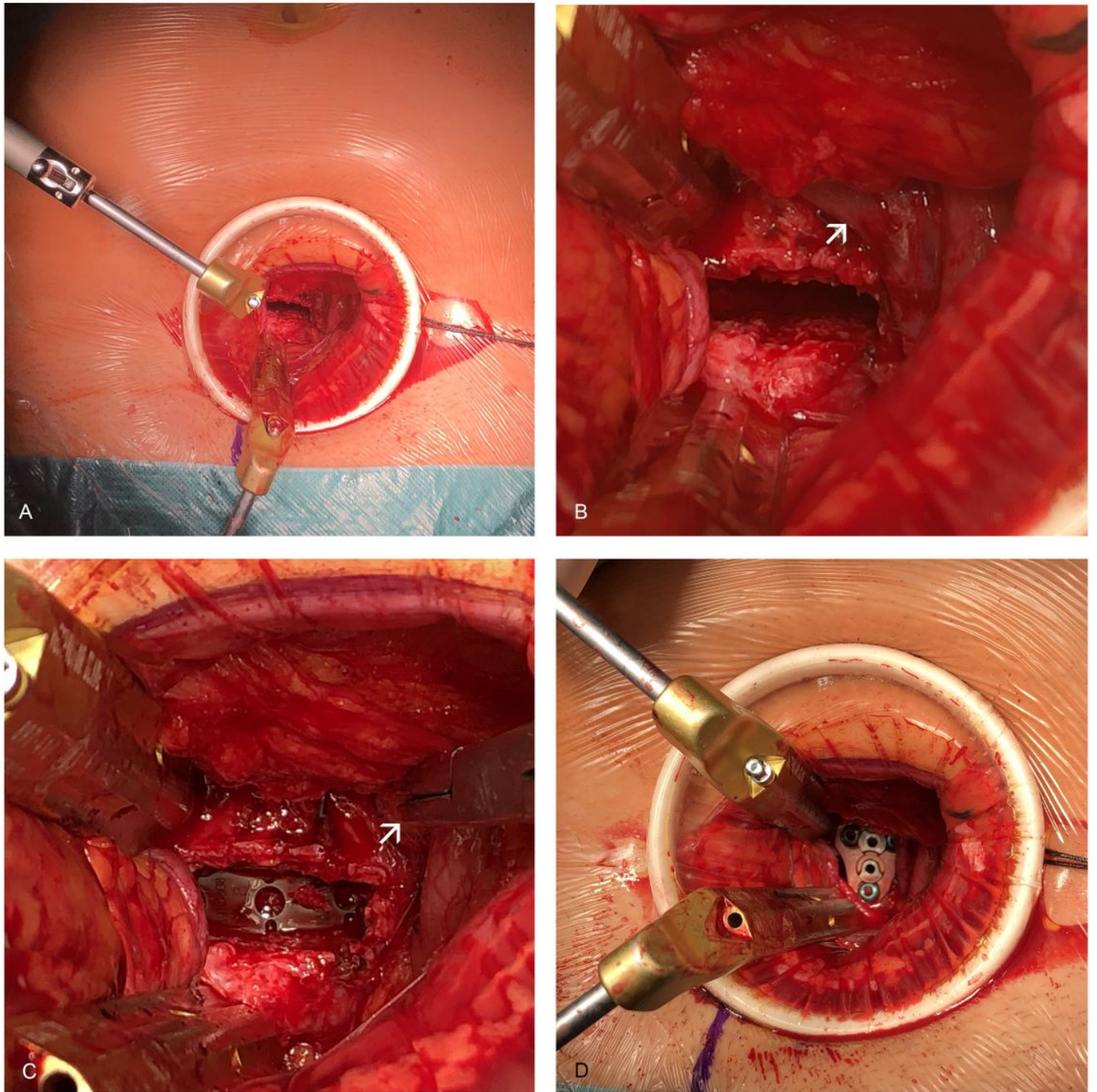


Figure 2

Exposure of the L5-S1 disc. A: Global view of the disk space. B: Opening of the disc space at L5-S1. C: Placement of the cage at L5-S1. D: Placement of the plate

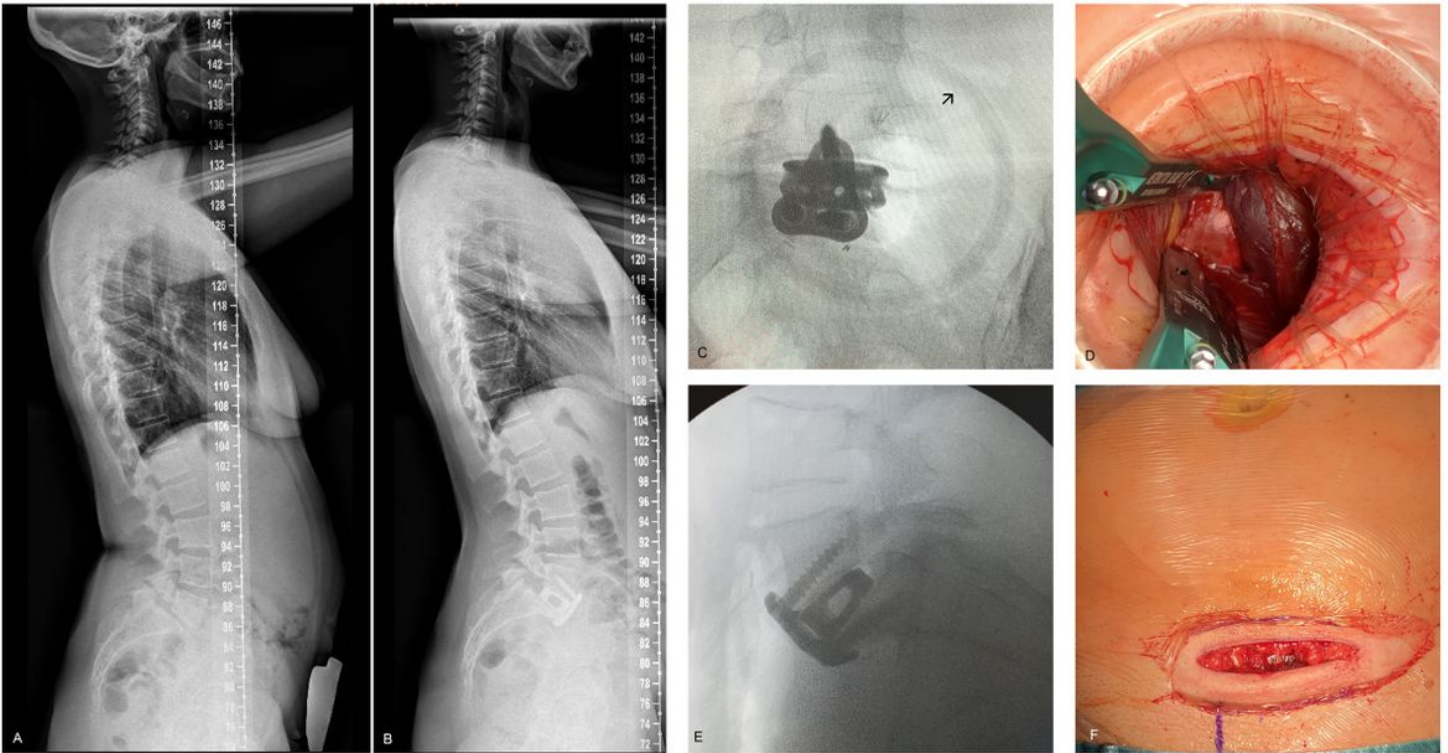


Figure 3

Stand- alone ALIF. A: Preoperative and post -operative (B) lateral X-rays of a patient with spondylolisthesis L5-S1. C: AP view of Alexis retractor with fluoroscopy. D: Disk space and Iliac vein E. Lateral view with fluoroscopy. The retractor is not present in field. F. incision after Alexis Removal

Supplementary Files

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- [CAREChecklist.docx](#)