Minimally Invasive Spine Surgeons of India

Minimally Invasive Spine Surgery

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CONTENTS

SECTION 1 Fundamentals

SECTION 3 MIS in Lumbar Spine—Non-instrumented

SECTION 5 Tumors, Infections and Osteoporosis

SECTION 6 Pain Management

3

CHAPTER

Concept of Tubes in Minimally Invasive Spine Surgeries

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ABSTRACT

The concept of minimally invasive spine techniques in the field of spine surgery has revolutionized the basic approach in handling spine pathologies. The use of Tubular Retractors in the last decade in India has given new dimensions for an effective and value based spine care. Initially, it was used for simpler procedures like diskectomy, till recently it is also used for canal stenosis, tumor, trauma and deformity corrective surgeries. This chapter focuses on the evolution of tubes in India and gives an overview of its Indications and uses.

INTRODUCTION

A basic tenet of surgery is to effectively treat pathology leaving "the smallest footprint." This is accomplished by designing procedures that require smaller incisions, resulting in less soft-tissue disruption, and involving limited surgical corridors. The development of these procedures has been implemented through technological advances in illumination, magnification, and instrumentation.

Tubular access to the lumbar disk was first reported by Faubert and Caspart in 1991 and this led to the way for development of tubular retractor systems and low profile instruments. The first report of the microendoscopic discectomy (MED) procedure came from Foley and Smith in 1997. The initial system utilized an endoscope, so was quickly adapted by the orthopedic surgeons due to their familiarity with arthroscopes. With the adaptation of the microscope to the use of tubular retractors in 2003, the METRx system (Medtronic, Inc.), more neurosurgeons implemented these techniques.

This chapter focuses on "tubular retractor", the work-horse of MISS. Many Tubular retractor systems are available in the market, but the basis of all systems is the same. The system consists of a series of concentric dilators and thin-walled tubular retractors of variable length. The spine is accessed via serial dilation of the cleavage plane between the muscle fascicles. The tubular retractors create a temporary, collapsible channel to gain access to the pathology, while leaving the the midline supporting musculoligamentous structures intact.

Due to familiarity with the instrumentation, we shall describe the METRx system.

METRX SYSTEM

The system consists of a series of metal dilators, a flexible arm assembly, the final tube and the source of illumination and magnification (endoscope or a microscope).

The metallic dilators range from 5.3 mm diameter (the first dilator) to 24.8 mm diameter (for the METRx X-Tube system). Each dilator has four concentric rings with a different colour-code at the superficial end **(Figure 1)**.Each dilator has markings on it to indicate the depth which in turn helps decide the length of the tube to be used. The first dilator (5.3 mm) needs to be threaded over a blunt tipped guidewire which is inserted under fluoroscopic guidance. Once the dilator is on the bone, the guide-wire is withdrawn. The dilator is then used as a Cobb elevator to sweep the soft-tissues off the bone, along with palpating the anatomical landmarks in both coronal and sagittal planes. Once the satisfactory position is achieved, serial dilatation with increasing diameter dilators is performed. It is important to

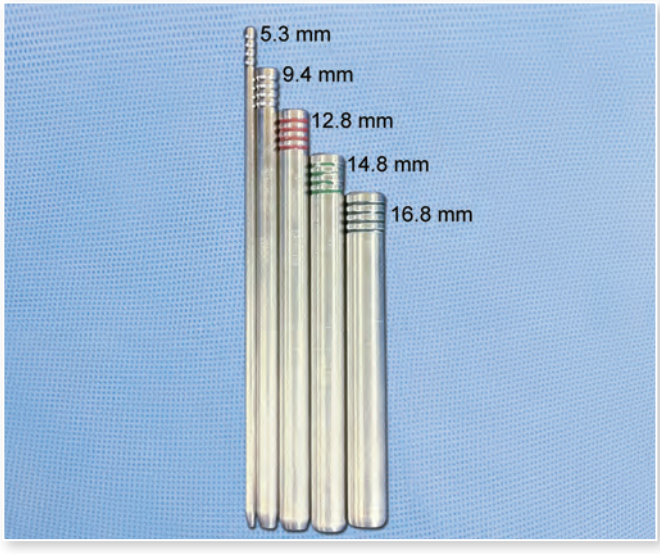


Figure 1: Different dilator sizes with color-coding

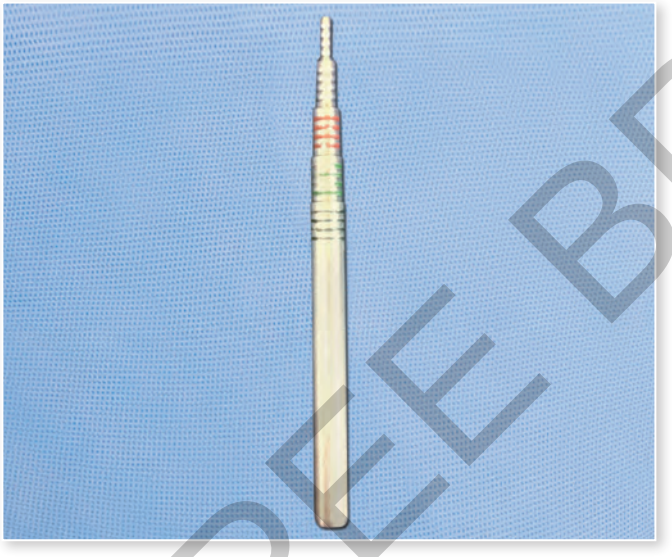
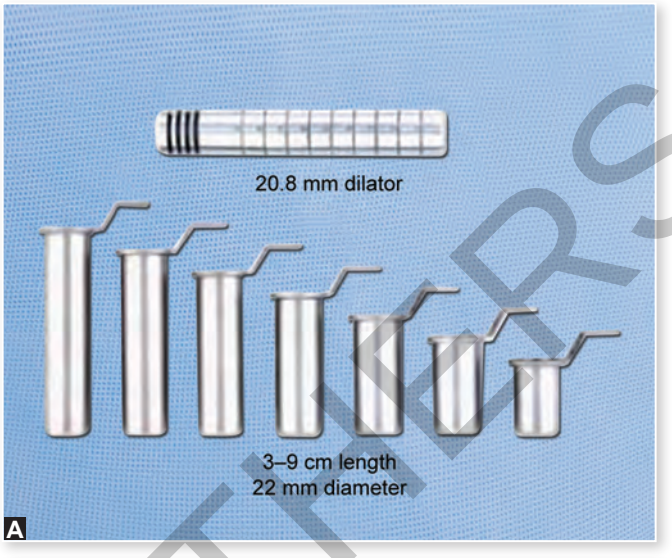
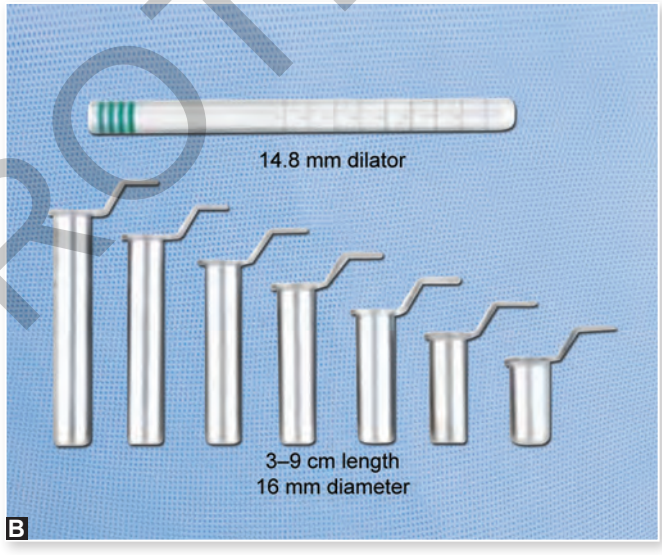


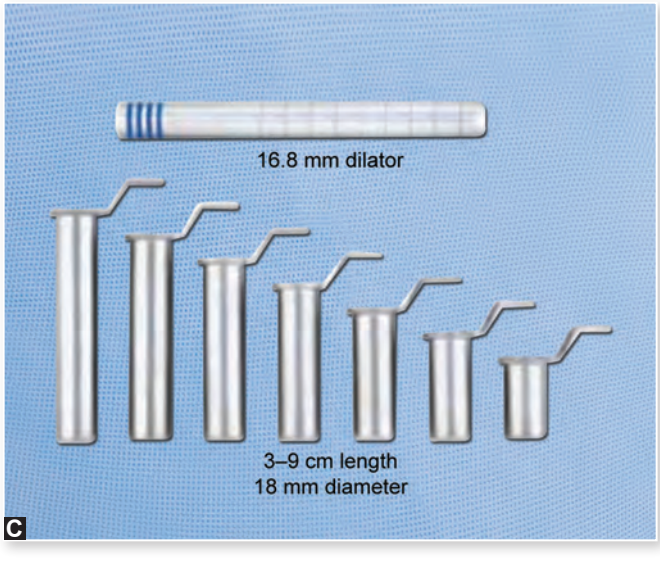
Figure 2: Arrangement of tubes. Note that all four rings are seen on each successive dilator

see all four rings of each dilator as the successive dilator is threaded over the previous one, to ensure proper entry and seating on the bone **(Figure 2)**. The dilators are introduced in gentle screwing motion.The calibrations on the final dilator are then used to determine the length of the final tube. Depending on the size of the tube being used the final dilator may be 12.8 mm (for 14 mm tube), 14.8 (for 16 mm tube), 16.8 mm (for 18 mm tube) or 20.8 mm (for 22 mm tube) **(Figure 3).**

We tend to use the 16 mm tube for diskectomies and 18 mm for lumbar canal stenosis decompression. It is advisable to use 18 mm tube for discectomy till requisite expertise is achieved. A 22 mm tube may be used for a TLIF or a PLIF







Figures 3A to C: Different sizes of final dilators and tubes. Note different lengths of the final tube available in each diameter

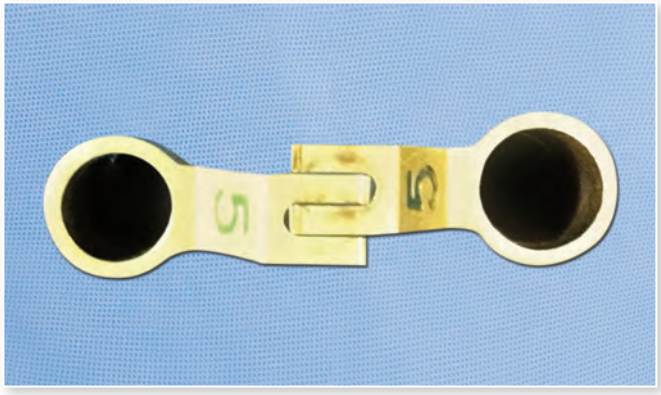
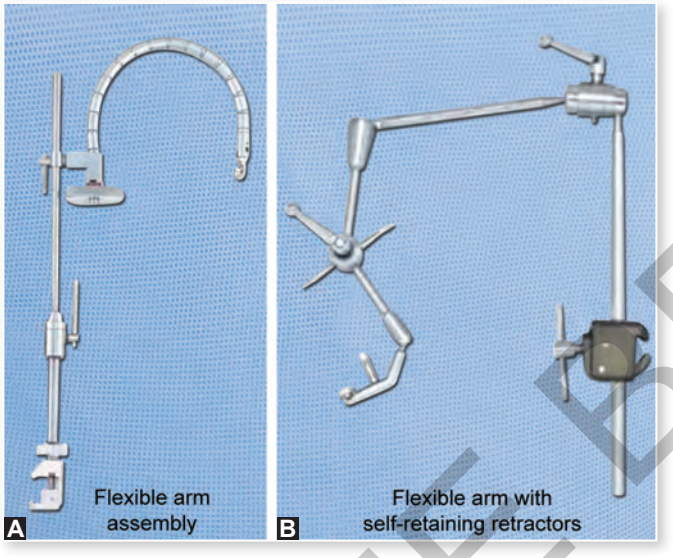


Figure 4: 16 mm tube (left) and the 18 mm tube (right). Note the number indicating the depth of the tube



Figures 5A and B: The two variants of the Flexible Arm Assembly

procedure, depending on the surgeons' experience. The final tube has a number etched on it which indicates the tube depth **(Figure 4)**. The tubes are available in a variety of depths from 3 cm to 9 cm, and a variety of diameters as discussed above.

Once the final depth of the tube is selected, the tube is threaded and attached to the Flexible Arm Assembly. This component is a post and a flexible arm with steel links or articulations **(Figures 5A and B)**. The assembly attaches to the operating table. The final tube is attached to the post by the arm and the connection is tightened to hold the tube firmly in position.

It is desirable to visualize the final seating of the tube in the lateral and/or the anteroposterior fluoroscopy image. Any final adjustments are made at this point. The dilators are then sequentially removed and the endoscope or the microscope is then used to visualize the anatomy.

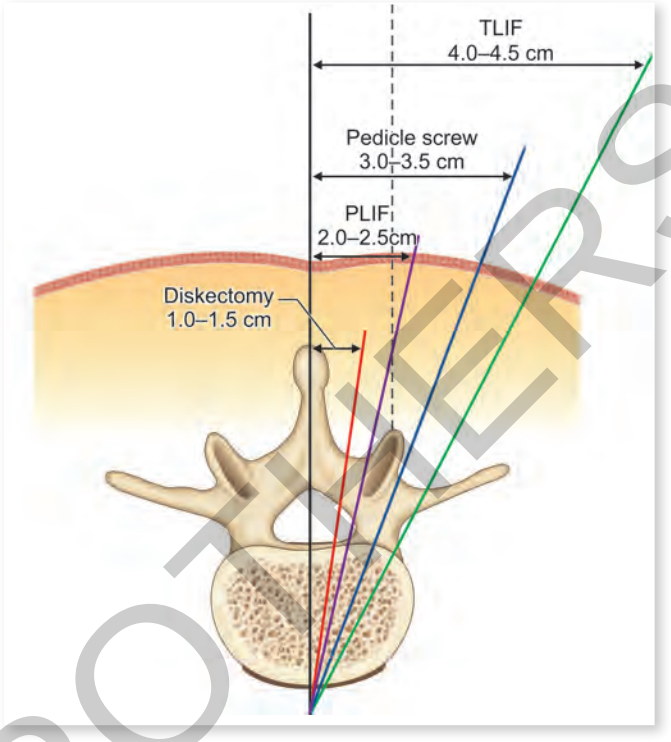


Figure 6: Recommended docking points

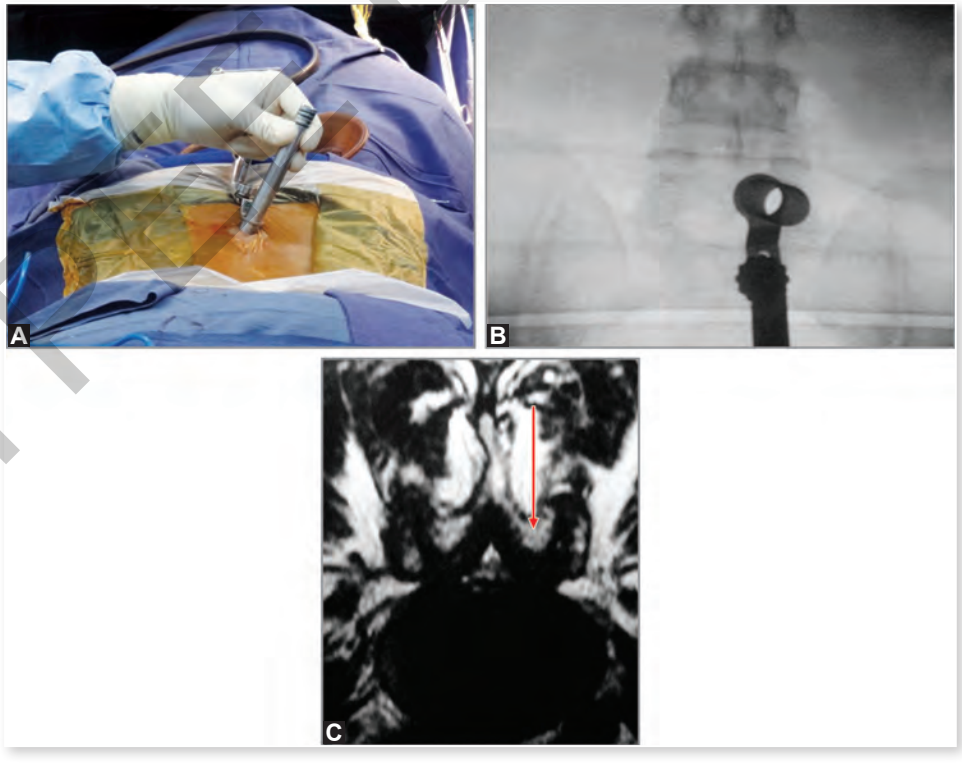
The system may utilize an endoscope or a microscope for the purpose of visualization, and illumination. The endoscope uses a television monitor for the visualization and the surgical field is visualized as a two-dimensional image. The endoscope is prone to fogging and requires frequent cleaning during the procedure. The microscope helps in direct visualization with a three dimensional effect and avoids the problems associated with fogging. The surgeon may utilize a powerful head-lamp and loupes to achieve the same effect, but loupes require constant adjustment of the neck to focus, each time the surgeons head moves. This can be quite cumbersome. There are different systems available for minimally invasive TLIF procedures which utilize illumination through the fiber-optic cables through a channel in the tube, and the surgeon uses the loupes for magnification.

The docking point of the tube varies with the procedure being performed. Our preferred docking points are as shown in the **Figure 6**.

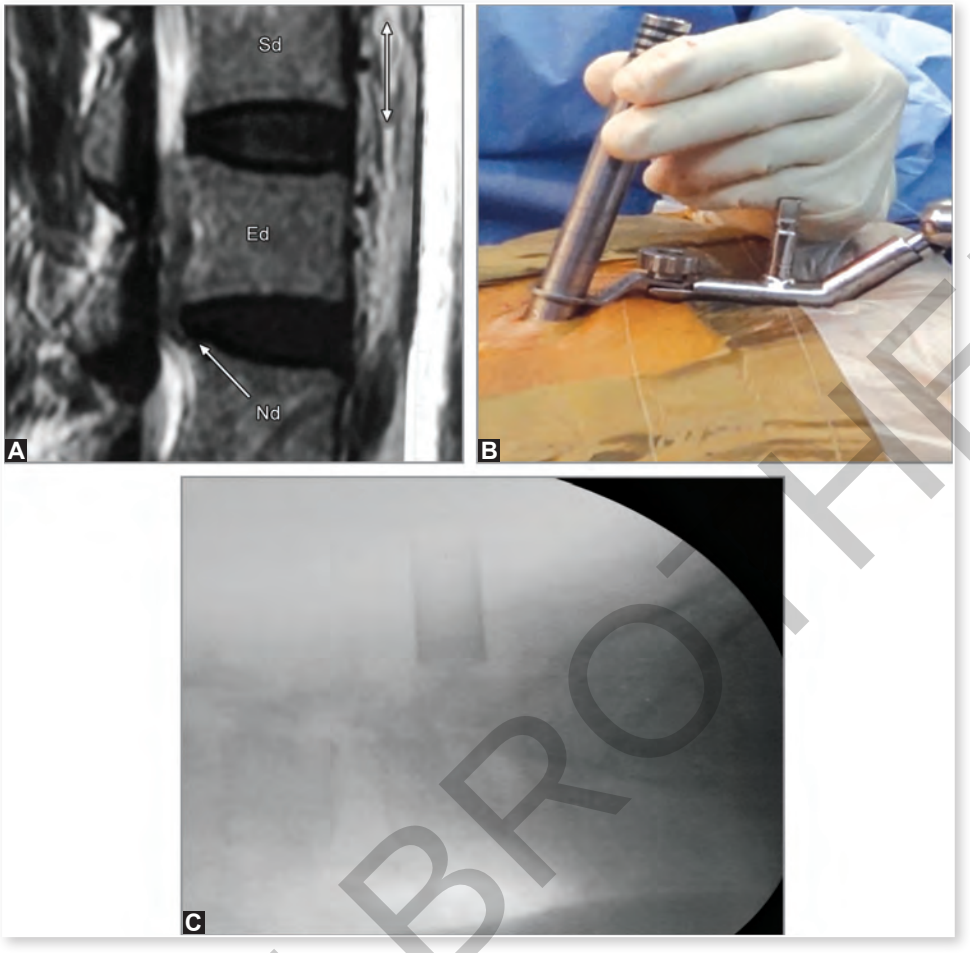
ADVANTAGES OF THE TUBES

Apart from the obvious advantages of the minimal disruption of the softtissues, the tube is a very maneuverable device. The tube can be used for contralateral decompression from an ipsilateral entry or two adjacent level pathologies

Figures 7A to C: Tube directed medially across the midline for contralateral decompression



Figures 8A to C: Tube directed laterally for ipsilateral decompression



Figures 9A to C: Tube tilted cranially for a superiorly migrated disk

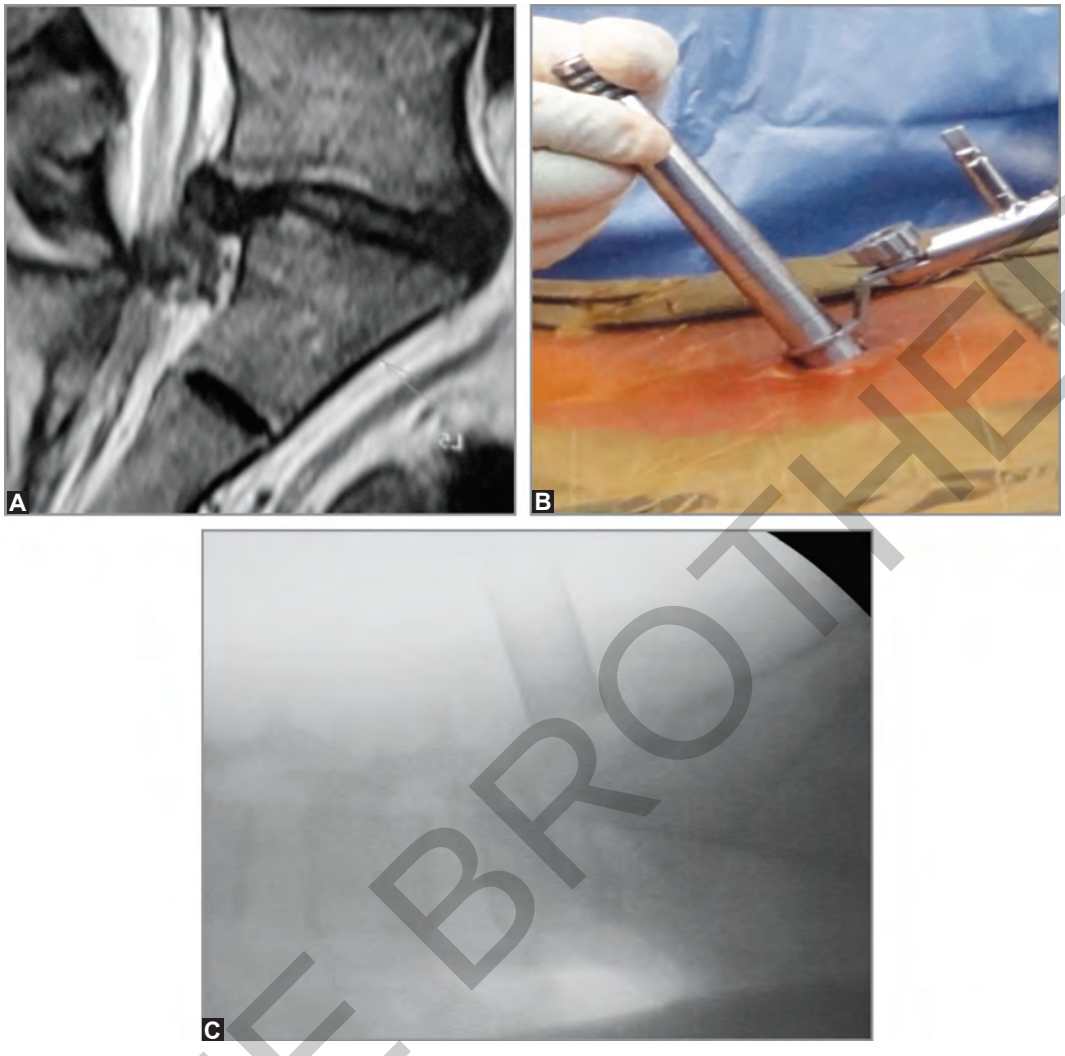
through a single port. This can be achieved by a technique called "wanding".

When performing contralateral decompression, the flexible arm assembly and the tube connection is loosened and the tube tilted to ipsilateral side so that the contralateral side can be visualized **(Figures 7A to C)**. In this process, the patient is tilted to the opposite side to aid in the visualization. Similarly an opposite maneuver can be carried out for ipsilateral lateral recess decompression **(Figures 8A to C)**.

The tube can be used to tackle pathology like a disk herniation or canal stenosis at two adjacent levels through the same port of entry especially if the pathology is at L4–5 and L5–S1 levels. This is achieved by manipulating the tube in the sagittal plane to visualize cranially or caudally **(Figures 9A to C and 10A to C)**.

The vision through the tube is thus not limited but substantial due to the maneuverability. This allows the surgeon to perform targeted decompressions over a wider area with minimal exposure **(Figure 11)**.

There is a steep learning curve associated with the tubular retractor assisted systems, but gaining expertise in the systems would widen the applications of this system to a variety of conditions. The tubular retractors are widely used for lumbar diskectomies, lumbar canal stenosis decompressions, minimally invasive TLIF/PLIF, posterior cervical foraminotomies, tumors and trauma. This allows a spine surgeon to deal with a majority of degenerative conditions through a minimally invasive approach. The various applications will be discussed elsewhere in this book.



Figures 10A to C: Tube tilted caudally for an inferiorly migrated disk

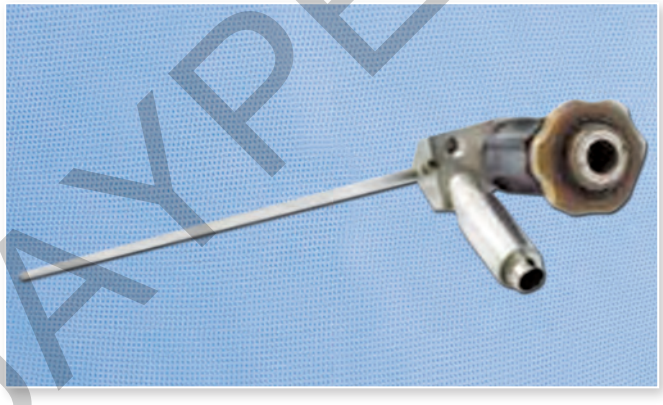


Figure 11: METRx MED system reusable endoscope

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Minimally Invasive Spine Surgery

The textbook is an official publication of Minimally Invasive Spine Surgeons of India (MISSI). MISSI is a registered congregation of like-minded spine surgeons whose mandate stands for development and propagation of minimally invasive techniques. With the common goal of achieving better surgical outcomes using the common thread of 'minimal access related tissue trauma', the association was formed in 2014 with Dr Arvind Jaiswal as the founder President and Dr Amit Jhala as the Secretary. The other founding members are Dr Shrinivas M Rohidas, Dr Satishchandra Gore, Dr Rajakumar Deshpande, Dr Subir N Jhaveri and Dr Arvind G Kulkarni. The association is growing in terms of membership and activities to expand the horizons of MIS in India in the way of workshops, live surgical sessions, publications, etc. This book is one such endeavor.

Salient Features

- Explores the subject of 'Minimally Invasive Spine Surgery' from basic fundamentals to recent advances
- Opens a world of fascinating techniques aimed at treatment with least morbidity
- Provides solutions to frequently asked questions about the 'ifs and buts' of minimal access spine surgery
- Encapsulates the experience of Indian MIS surgeons since the inception of MIS in India.

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