Thoracoscopic Correction of Adolescent Idiopathic Scoliosis

An essay submitted for partial fulfillment of the Master degree in orthopaedic surgery by

Ahmad Nabil Marzban

Under supervision of

Dr. Naguib El-Desouky Basha

Professor of Orthopaedic surgery

Faculty of Medicine,

Cairo University

Dr. Hossam Salah El-Din Taha

Assistant Professor of Orthopaedic surgery

Faculty of Medicine,

Cairo University

Cairo University

2008

Abstract

Adolescent Idiopathic Scoliosis is by far the most common type of scoliosis in orthopaedic practice, other types include: congenital, neuromuscular and degenerative. Treatment of Adolescent Idiopathic Scoliosis includes observation, bracing and surgery.

Surgical techniques have evolved considerably over the last 50 years starting by posterior instrumentation and fusion. Afterwards, anterior instrumentation was developed with the advantage of greater curve correction. Recently, thoracoscopic release, instrumentation and fusion were developed.

In this essay, technique, advantages, disadvantages and complications of thoracoscpic correction of Adolescent Idiopathic Scoliosis will be discussed in comparison with the conventional open techniques

Key words: Adolescent Idiopathic Scoliosis – thoracoscopic - instrumentation

بسم الله الرحمن الرحيم

" يرفعِ اللهُ الذينَ آمنوُا منكم

و الذينَ أوتوا العلمَ درجاتٍ "

المجادلة آية ١١

CONTENTS

Acknowledgements

He and will always be Allah Who blessed my work

and Who sent me those who were of help

My family *was of the greatest help. Thanks to my parents' encouragement, their invaluable assistance was very fruitful.*

I am bound in honour to ***Dr.Naguib Basha****, Professor of Orthopaedics, Cairo University, who gave me much of his time & effort. He taught me how to specify my goal and work to it.*

Finally, I would like to express my deepest gratitude to ***Dr. Hossam Salah****, Assistant Professor of Orthopaedics, Cairo University, for his great guidance and patience throughout the whole work.*

LIST OF FIGURES

A- ANATOMY

B- CLASSIFICATION

C- TECHNIQUE

D- RESULTS

List of abbreviations

- **AIS:** Adolescent idiopathic scoliosis
- **AVR:** Apical Vertebral Rotation
- **AVT:** Apical Vertebral Translation
- **CSVL:** Center Sacral Vertical Line
- **PUMC:** Peking Union Medical College
- **OAISF:** Open Anterior Instrumentation and Spinal Fusion
- **SRS:** Scoliosis Research Society
- **TAISF:** Thoracoscopic Anterior Instrumentation and Spinal Fusion
- **VATS:** Video-Assisted Thoracoscopic Surgery

Introduction

The term scoliosis is used to describe a condition which represents an abnormal curvature of the spine, but it is not a disease or diagnosis. It usually develops in thoracic spine, or thoracolumbar area of the spine. It may also occur just in the lower back. The four most common causes of scoliosis include congenital which is relatively rare, neuromuscular (myopathic scoliosis), degenerative (adult scoliosis) and idiopathic which is by far the most common cause of scoliosis diagnosed by exclusion and since its occurrence is often during adolescence it is sometimes called adolescent scoliosis. ***(King, 2003)***

It is actually a three-dimensional problem composed of torsion, angulation and translation simultaneously occurring in the transverse, coronal and sagittal planes. It is the most common disorder of the spine encountered by pediatricians and pediatric orthopedic surgeons. It can affect physical appearance dramatically and has both physiological and psychological impact. ***(Parent et al, 2005)***

Treatment of scoliosis includes observation, bracing and surgery. Surgical techniques have evolved considerably over the last 50 years in terms of effectiveness and safety.

In the late 1950s and early 1960s, Harrington developed a reliable instrumentation for correcting and fusing the spine via posterior approach (commonly referred to as posterior spinal fusion and instrumentation). However Harrington instrumentation had a uniplanar approach to correcting coronal curvature. ***(King, 2003)***

In the early 1980s, Cotrel and Debousset developed segmental instrumentation, which allowed three-dimensional correction which is now the "gold standard" for surgical treatment of scoliosis.

Dwyer and coworkers applied instrumentation concepts to surgery of the anterior portion of the spine in case of lumbar and lower thoracic portions of the spine with the primary advantage of greater deformity correction. Increased morbidity of anterior surgery has been lessened by the development of thoracoscopic techniques. ***(King, 2003)***

The technique of thoracoscopy was first described in 1910 by Jacobeus, a Swedish physician who used a cystoscope to examine pleural space. Although thoracoscopy was initially performed for diagnostic purposes, it later evolved into a therapeutic procedure. ***(Flores et al, 2005).*** In October 1996, thoracosocpic scoliosis instrumentation was first done. ***(Das, 2000)***

In the following essay, we are going to discuss technique, advantages and disadvantages of thoracoscopic correction of Adolescent Idiopathic Scoliosis compared to the conventional open techniques, under the following headings:

I- Thoracoscopic ***Anatomy.***
II- ***Classification*** *of Adolescent Idiopathic Scoliosis*
III- ***Technique*** of thoracoscopic correction *of Adolescent Idiopathic Scoliosis*
IV- ***Results*** of thoracoscopic surgery in correction of *Adolescent Idiopathic Scoliosis.*
V- ***References***

Thoracoscopic Anatomy

Thoracoscopic Perspectives of Thoracic and Mediastinal Anatomy

(Wolf et al, 1999)

This chapter reviews intraoperative endoscopic views of thoracic and mediastinal structures, focusing on the anatomy of the paraspinal soft tissue. Knowledge of this anatomy is required for the safe practice of thoracoscopic spinal surgery. All pictures are taken with a rigid 30°-angled endoscope introduced through a portal placed laterally in an intercostal space, just above the diaphragm, to provide a panoramic view of the thorax.

The anatomy of the thorax is viewed in four regions: the thoracic outlet, the upper thorax, the middle thorax, and the lower thorax. The anatomical components of each region visualized thoracoscopically are shown in intraoperative photographs obtained during thoracoscopic surgical procedures. A few common thoracoscopic surgical procedures related to the thoracic spine are also used to demonstrate the anatomy.

RIGHT THORACIC OUTLET

At the right thoracic outlet, the right subclavian artery and vein are seen after the first rib has been resected ***(Fig. 1).*** The subclavian artery is partially covered by the adjacent subclavian vein; it exits the chest cavity beyond the first rib posteriorly and courses parallel to the subclavian vein. From anteriorly to posteriorly, the subclavian vein, subclavian artery, and brachial plexus lie within a groove on the first rib. These structures are revealed after the first rib was resected to treat thoracic outlet syndrome.

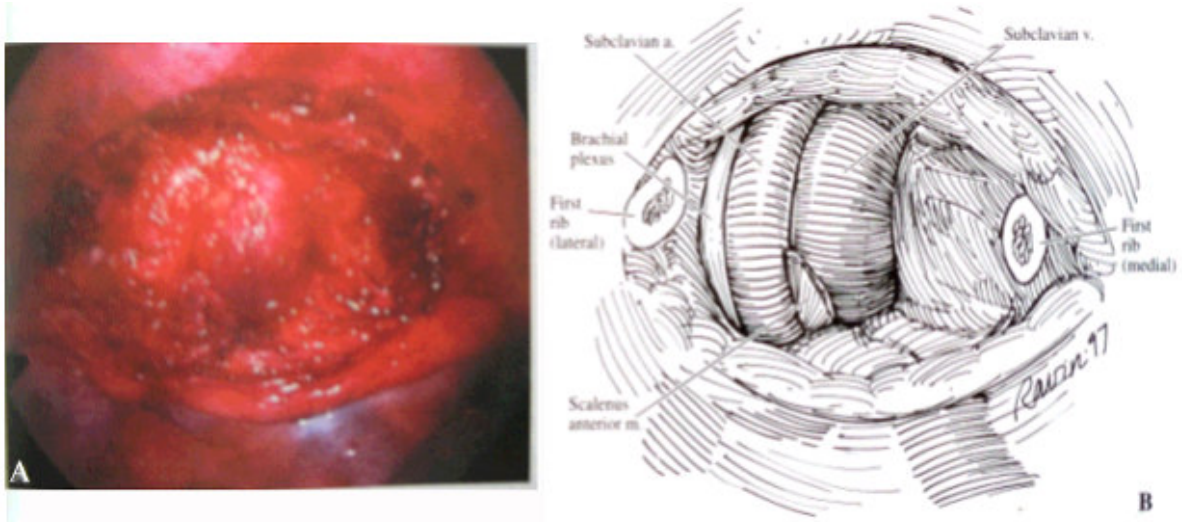

Figure 1 (A) Thoracoscopic view and (B) corresponding illustration of the right thoracic outlet after the first rib has been resected.

RIGHT UPPER THORAX

In the right upper thorax, the large right superior intercostal vein is visible on the surface of the vertebral bodies ***(Fig. 2)***. It receives drainage from the second and third intercostal veins and empties into the azygos arch. The azygos arch is formed at the level of the T_4 vertebra over the root of the lung and empties medially into the superior vena cava.

The supreme (first) intercostal vein, positioned lateral to the vagus nerve, is usually not visible and empties directly into the right brachiocephalic vein. Typically, the second rib is the first rib structure visible endoscopically when the upper thorax is viewed. The first rib can be palpated, but the first rib and rib head are seldom readily visible because they are covered by apical fat, the brachiocephalic vessels, and the stellate ganglion.