Integrated Operation Theater Spine Suite (IOTSS) History of Spine Surgery: Lord Krishna the First Eternal Spine Surgeon

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Abstract

The Mission has been to improve the quality of human life and do no harm. The significant change experienced during the training at England 1991 to 1996. Saga to be the best, be different and be unique continued. Necessary equipment installed like C Arm for fluoroscopy, radiolucent operation table and Anaesthesia machine. Safety increased due to optimisation of the operating room by implementation of available gadgets.

Many of us have witnessed the transition of an era, from handwritten Operation schedule call books to smartphone apps., from manual typewriters to high tech computers for research, from manual slide carousel to virtual presentations, from written high-risk consent to video consent and now from high radiation and lead aprons to Zero radiation exposure with O-Arm and navigation.

Integrated Operation Theatre Spine Suite– Enabling Technology - IOTSS is the latest version in optimising and additionally maximising the advantage of the surgery.

Keywords: Integrated spine suite, Optimizing results, Spine surgery

Introduction

Lord miraculously corrected the spine deformity of Kubja by stabilizing her feet and pulling her from chin - NO Operation Theater [1].

Sushruta (c. 600 B.C.) considered as the "founding father of surgery"

Aboriginal Operation Theater

Some journeys through time remind us of the presence of evolution and its integration into our existence. Right from medicine to technology, the Vedic era has been a testament to such progression. Traced through the Bower Manuscript, this history of aboriginal health camps and their frontline workers came to light with a particular sage from the Hindu religion. Between 1200 BC and 600 BC, Sushruta performed procedures that are still the benchmark in the modern science of surgery, archived in Suśrutasamhitā. The manuscript has played an important role in emphasizing various surgical training, instruments, and techniques [2].

My journey from resident doctor to a spine specialist to a technology-enabled spine specialist has been pertinent to my mother. She suffered from an intradural DL tumor with neuro deficit. From Residency at Civil Hospital to Stavya Spine Hospital has been a journey of 35 years. I have witnessed the transition of surgeries from no implant and open surgeries to multilevel keyhole implant fixation surgeries. From clinical diagnosis progressed to advanced investigation such as magnetic resonance imaging (MRI) neurography and MRI tractography. Operation theater has been the TEMPLE for me; it gave me positive vibes to make someone better. My residency started with self-developed radiographs with portable X-ray machines, ether anesthesia, no suction machines, and galveston cautery. Even with limited available resources, the operating rooms will function for 20 h a day.

Spine surgery and healthcare have witnessed a vast, challenging surge in technological advances.

Optimized Operation Theater

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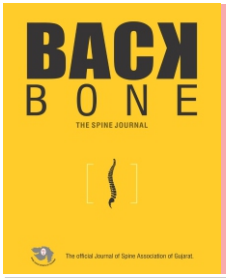

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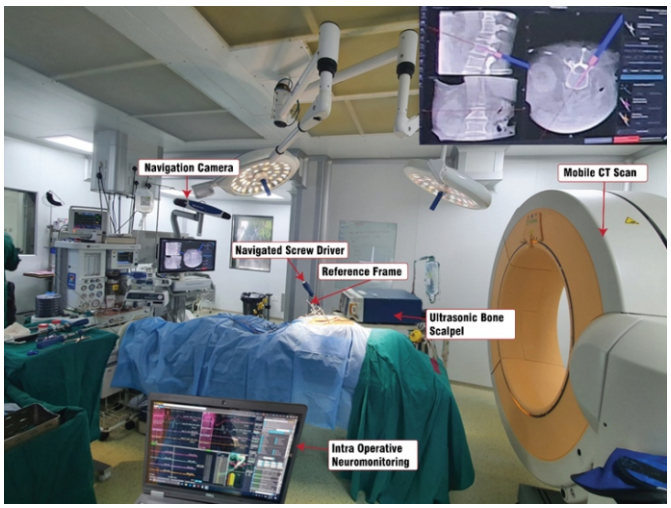

Figure 1: Integrated Operation Theatre Spine Suite

Figure 2: Intraoperative O Arm, positioned with the patient on radiolucent table

as C Arm for fluoroscopy, radiolucent operation table, and anesthesia machine. Safety increased due to optimization of the operating room by the implementation of available gadgets. Many of us have witnessed the transition of an era, from handwritten operation schedule call books to smartphone apps., from manual typewriters to high tech computers for research, from manual slide carousel to virtual presentations, from written high-risk consent to video consent, and now from high radiation and lead aprons to zero radiation exposure with O-arm and navigation.

Integrated Operation Theater Spine Suite– Enabling Technology - IOTSS

Integrated: combining or coordinating different elements to provide a harmonious, interrelated structured function cooperatively.

Operation: the procedure of cutting open a patient's body to deal with a part inside, an organized activity that involves many people doing different things.

Theater: An operating room is a hospital facility where a surgical procedure is performed in an aseptic environment.

Spine surgery is dealing with mobile segments which house the nervous system.

Suite: A suite is a collection of matching things.

The era of technological advances is at its peak.

"Wholeness is not achieved by cutting off a portion of one's being, but by integration of the contraries." Carl Jung (Swiss Psychiatrist - 1875-1961). "Affordable healthcare is a necessity in a developing country like India; inducting IOTSS was a challenge. But with a strong appetence, surgical packages are made all-inclusive and pocket-friendly for the better outcome." CEO, Stavya.

Integration is a fundamental law of life; if not adopted, disintegration is the natural result. When we talk about integration in spine care, it is the act of uniting techniques of expert spine surgeons with the most advanced technology leading to subspeciality development in Spine Surgery. Integrated operation theater spine suite is a well-equipped Class 100 operation theatre with a mobile Computer Tomography (CT) scan machine, a navigation system, a neuromonitoring system, and ultrasonic bone cutting/shaving instruments. Imagine removing a disc and putting pedicle screws on a playstation. The spine suite is equipped with the best technology to navigate implants, neuromonitoring, and intra-operative CT scan, making the pedicle screw placement precise and accurate. The amalgamation of the gadgets enhanced safety, greater confidence, accuracy, and tissue respect in open surgeries, minimally invasive surgeries, and complex cases. IOTSS helps in improving the capabilities of the surgeons and surgical team and ensures a safe environment for the patient [3]. It increases surgeon confidence and expands the horizon of complex cases. Functional inabilities converted into abilities, and abilities converted into utmost safety with zero radiation.

The motive continued safe spine surgery with the adoption of enabling technology with Artificial Intelligence (A.I.). The use of intra-operative C.T. scan and navigation has dramatically improved upon safely placing implants in critical cases. Any deviation from normal anatomy, making the surgeon opt for the best possible surgical plan. This technology benefits complex spine deformities such as kyphoscoliosis, craniovertebral junction, revision surgeries, and minimally invasive surgeries [3]. The chance of getting a C.T. scan intra-operatively further eliminates the possibility of wrong level surgery. It detects any screw breach so that corrective measures can be taken immediately. The IOTSS has laminar airflow systems that use high-efficiency particulate Air Filters, which can also remove smaller than 1-micron particles. Thus, the usage of ultra-clean air minimizes infection rates significantly in the O.T. setting. A sharp knife cannot cut something

precisely till the hand holding the knife is trained and experienced. Expertise in spine surgery with hard work, dedication, and knowledge is the essential part of IOTSS. Experience with expertise and technology combined can make a car fly, make a spacecraft reach mars, and make the most complicated spine surgical cases safer.

IOTSS – Observations by Users

IOTSS is an A.I.. A.I. is a disruptive technology that will keep on upgrading and seems to have no downturn.

IOTSS prevents deadly complications at craniovertebral junction; virtual visualization saves the imperious structures and enables the safe placement of implants.

A.I. is a present-day system that offers real-time help and manages to prove itself.

IOTSS saves the surgeon's heartbeat when operating in junctional areas, complex anatomy, and unexpected perioperative surprises. Nothing can surpass the need for per-operative ease of the surgeon.

Integration of the latest technology on the A.I. platform aligns the surgeon's confidence for real-time execution. It is the way for the future.

IOTSS is the conglomerate of State of Art Enabling technology that takes Spine Surgery's safety to Zenith of possibilities. IOTSS ensures the Best Standard of Care and Clinical outcome, guarded as one of the best in the world.

Being the Gen Z of the Stavya family, my experience with A.I. in the O.T. has been excellent. Providing the virtual world with authentic, scientific information in a user-friendly way is our duty and a necessity.

Limitations and Downsides of IOTSS

Having seen the era of least technology to use of A.I. in medical science makes us think about the downsides.

A.I. likely to replace most of the surgical skills of Baby boomers and Gen X. All Baby boomers, Gen X, Y, and Z may sail on the same platform with A.I.

The surgeon may forget the basic open techniques.

Surgeons will be Dependent on technology, theater assistant and A.I. – cannot perform surgeries without IOTSS.

IOTSS becomes a necessity, will become Market driven and need upgradation.

Users of A.I. will say, it increases accuracy, facilitates complex surgeries, an excellent tool for MISS with zero radiation".

Nonusers will say high cost, lack of adequate training, equipment issues, learning curve, and tech dependency.

At Stavya, we have found limitations –

Accuracy check is frequently needed because of reference frame displacement.

Likely to go wrong when used with neuromonitoring and A.I. due to patient movement. Surgical maneuvering can increase error too.

Only six vertebrae seen simultaneously, long segment two frames, >2 C.T. scans, increases radiation.

Cervico thoracic junction in an obese patient, the scan may not be well defined

Staff education, especially important to maintain the gadgets, etc.

Moreover, virtual imaging is NOT the REAL TIME imaging.

To summarize

IOTSS is the next step to enhance the patient's safety and improve the outcome and surgeon's comfort (tech friend AI).

Per operative after instrumentation, O Arm spin will give the best possible result.

Before implementing the use, limitations and dependency should consider. However, it certainly gives comfort in complex cases and will reduce the lawsuits.

You are responsible for what you do, progeny to patient treatment. A physician can bury his mistake; an architect hides his mistakes by plant and posters; a surgeon's mistakes will be evident on imaging.

Future Challenges

A. Google doctor, Gen Z, or millennials will be dictating and influencing the decision Clinical and operative [4].

B. Practice scenario has changed, availability of investigation tools at district and town levels have led to overdiagnosis, inept diagnosis, and ineligible treatment.

Future Advances

In AVERPI (Audio, Video, medical Equipment, Room environment, Picture archive and communications System [PACS], and Information system) level integration, the O.T. spine suite will be at least an AVERPI level of integration. The Integrated O.T. spine suit to be connected to other facility areas, such as radiology and laboratories. The highest level of integration is an AVERPIT level [5]. The most fully integrated systems, at the AVERPIT level, add telemedicine, which connects the Integrated O.T. Spine Suite to the outside world. Audio/videoconferencing extends communication abilities to conference rooms and classrooms across the street or the globe so that surgeons can consult and teach remotely. Adding Robot in Spine Surgery and 3D technology seems inevitable.

Incredible things can be done simply if we are committed to making them happen – Sadhguru ISHA Foundation

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Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the Journal. The patient understands that his name and initials will not be published, and due efforts will be made to conceal his identity, but anonymity cannot be guaranteed.

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