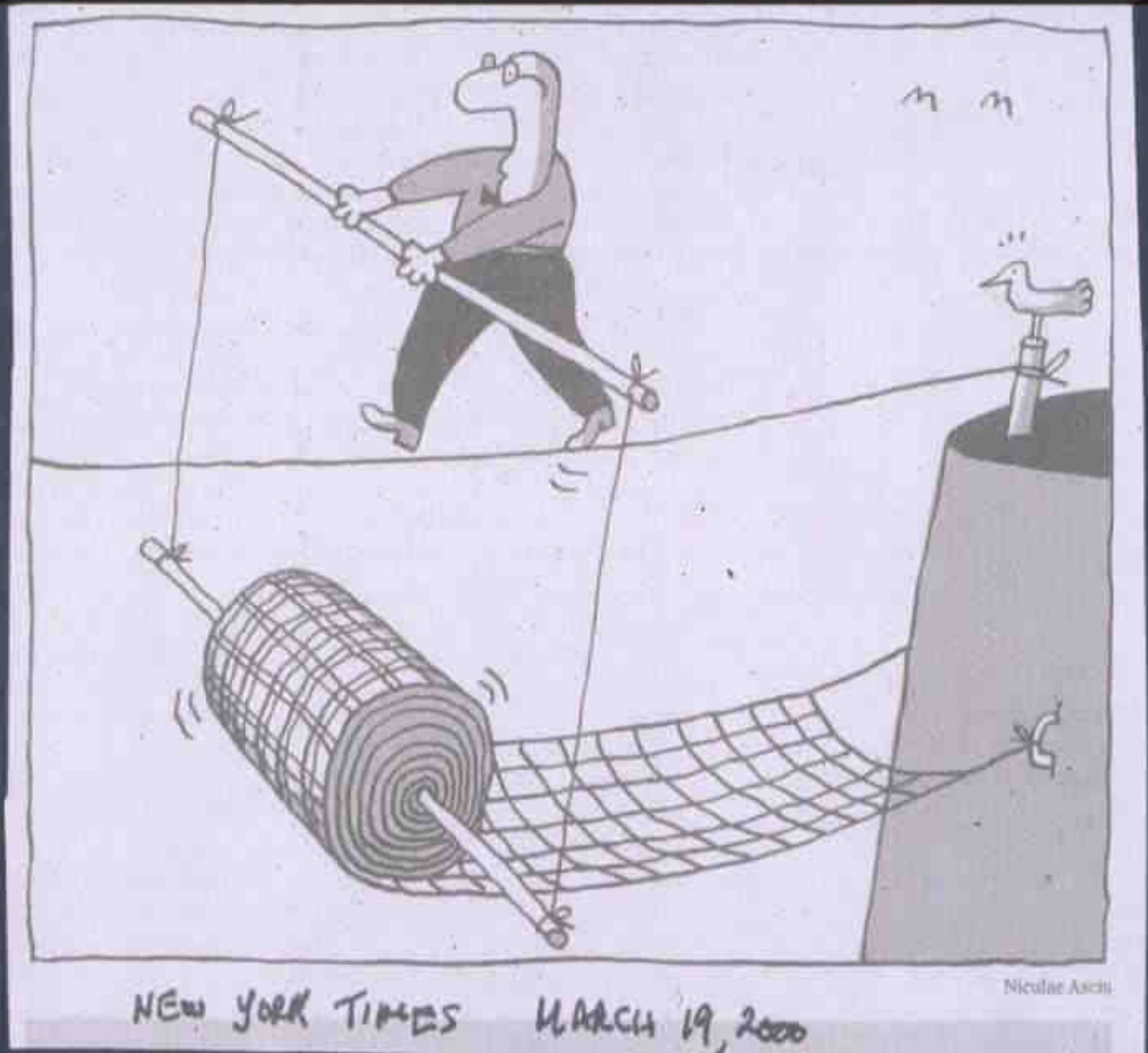
Error in the World of the Surgeon

There are some patients we cannot help.

But there are none we cannot harm!

Two Components of Error

- Human factors.
- System deficiencies.



NEW YORK TIMES MARCH 19, 2000

Patient Safety

- Definitions: Error
  Patient Safety
- Incidence of error.
- The literature on error.
- Causes of error.
- Prevention of error.
- Prospective error research.
- Disclosure of error.

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Definition: Error

- The failure of a planned action to be completed as intended (an error of execution), or the use of a wrong plan to achieve an aim (an error of planning).
- It would have been considered wrong by one's peers.

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- The true incidence of error is poorly understood because most recording of it is retrospective which is flawed.
- It is estimated error may cause 100,000 deaths per year in the USA.
- Countless extra days in hospital.
- Billions of dollars in extra costs.

- It is estimated that there is a 6% chance per day of a medication error happening to a hospitalised patient.
- So an inpatient for 17 days has a 100% chance of experiencing at least one medication error.

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Error: Literature

- Mostly retrospective chart reviews.
- Very few prospective studies done.
- Attention was initially raised by some high profile cases in the lay media.

Surgery Is Done On Wrong Side Of a Brain

Published: June 25, 1995

Responding to a botched brain operation, officials of Memorial Sloan-Kettering Cancer Center in Manhattan have instituted new operating-room procedures, a hospital spokeswoman said yesterday.

On May 26, Rajeswari Ayyappan, the 59-year-old mother of the Indian actress known as Sridevi, underwent surgery for a malignant tumor on the left side of her brain. The tumor, however, was left intact because her neurosurgeon took another patient's X-rays into the operating room and operated on the wrong side of Mrs. Ayyappan's brain.

Mrs. Ayyappan was transferred to New York Hospital-Cornell Medical Center, where another surgeon removed the tumor. She was in stable condition yesterday.

A spokeswoman for Memorial Sloan-Kettering, Christine Westerman, said yesterday that the neurosurgeon, whom she would not identify, had lost surgical privileges and that the case had been referred to the New York State Department of Health.

Retrospective Studies

Country	N	Year	Incidence of AE	Percent of Error
Australia	14,000	1995	16.6%	**51%**
USA (Utah & Colorado)	15,000	2000	2.9%	**48%**
England	1014	2001	11.7%	**50%**
New Zealand	1326	2001	10.7%	**71.8%**
Denmark	1097	2001	9.0%	**40.4%**
Canada	5000	2004	7.5%	**37.8%**

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Error: Causes

- **Organizational factors** (e.g. RN staffing levels on weekends)
- **Task factors** (e.g. clarity of task steps)
- **Situational factors** (e.g. equipment design)

Error: Causes continued

- **Individual factors** (e. g. sleep deprivation)
- **Patient factors** (e. g. co-morbidities)
- **Team factors** (e. g. communication)

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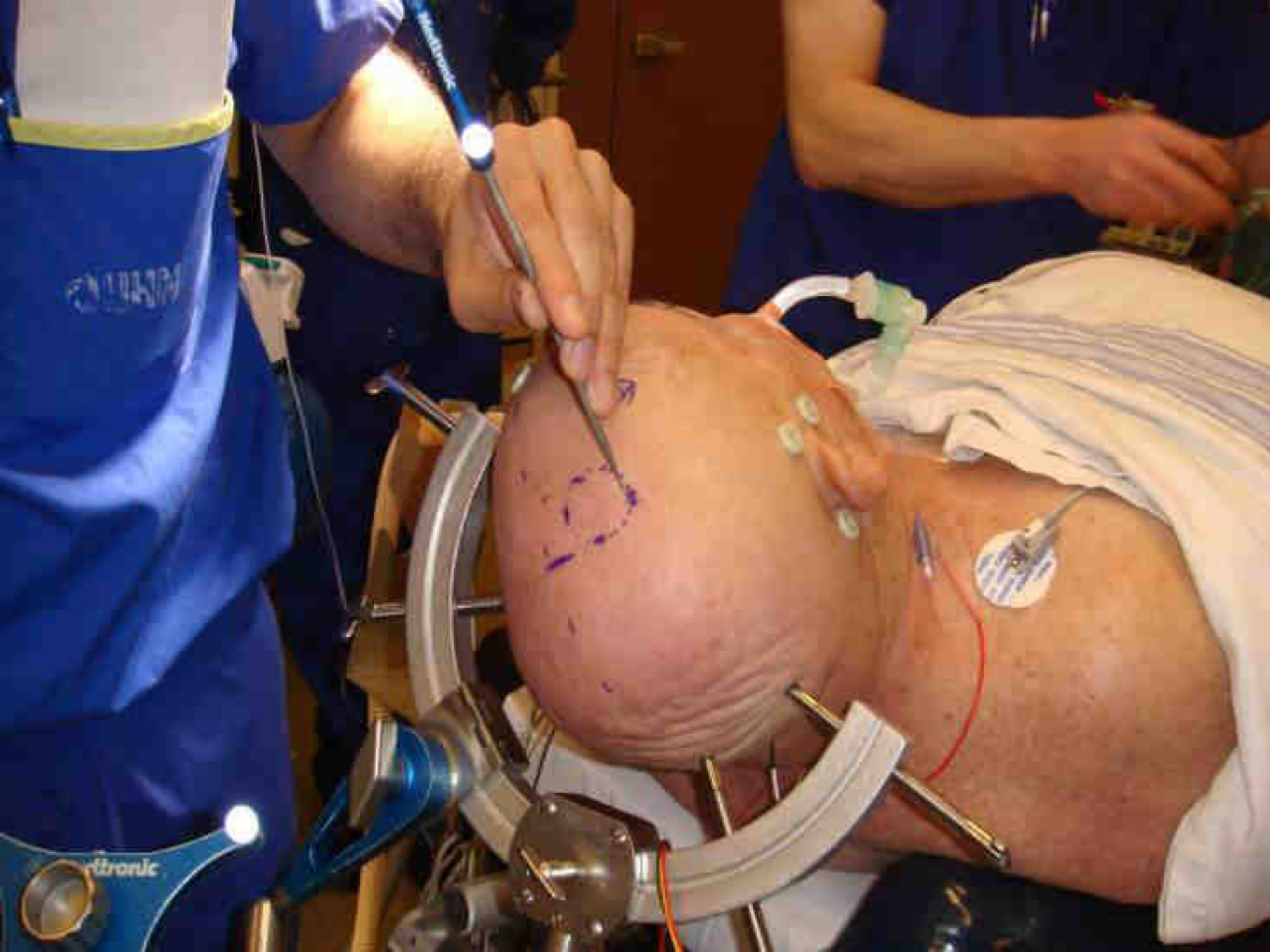
Error: Prevention

- Improve measurement of errors.
- Create a culture of safety.
- Embrace a systems approach:
  a) know what you are fixing (root cause analysis).
  b) new ways may also be flawed.
  c) forcing and constraining functions.
  d) challenge the authority gradient.

Example of Forcing Functions

- One cannot put too much KCl in the IV solution if the bags are pre-mixed with the right amount.
- One cannot operate on the wrong side of the head using a surgical navigation system.

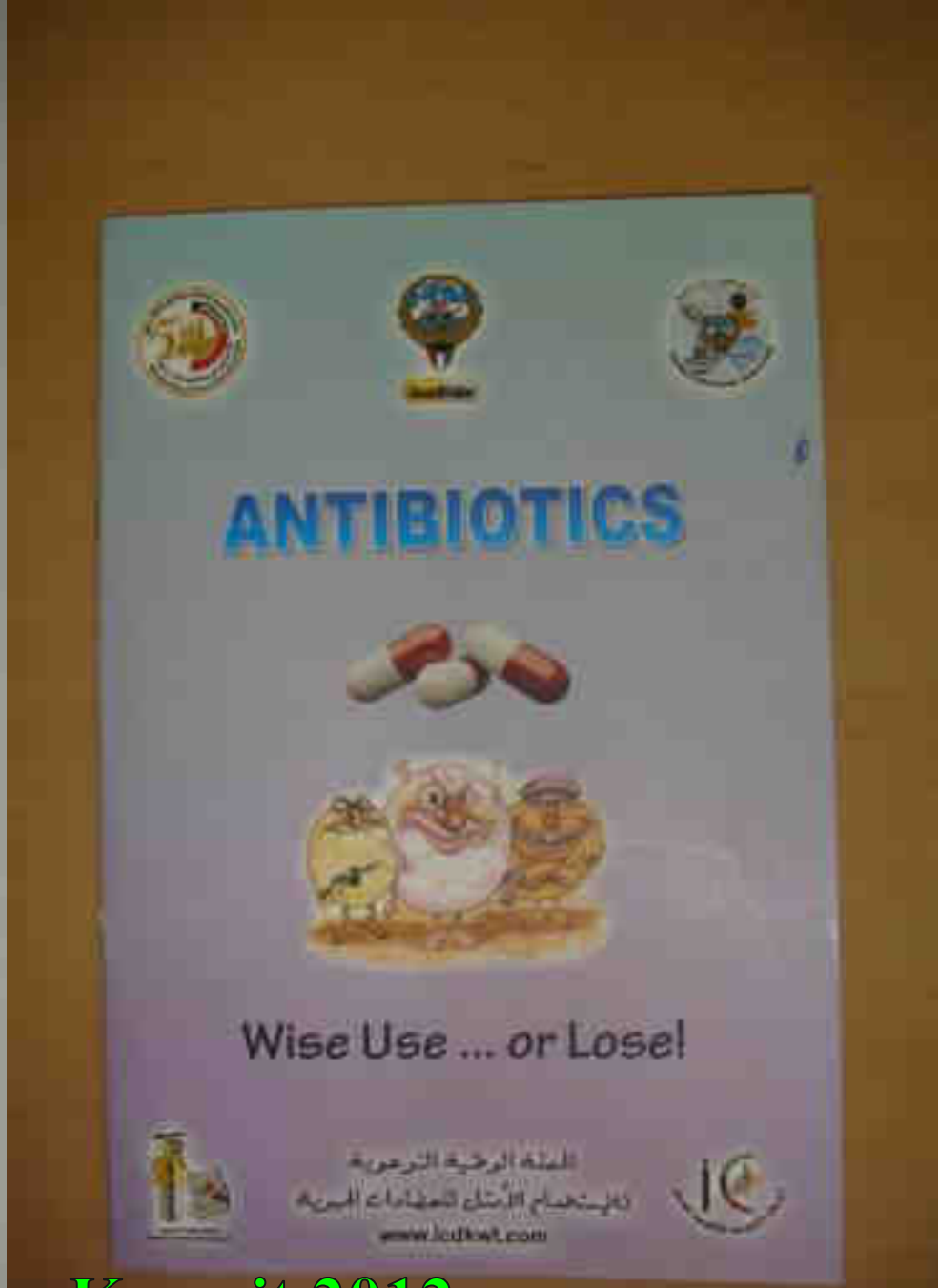



S
S
A
S
R
Passive Planar, Blunt
Small Passive Cranial Frame

Examples of Constraining Functions

- The patient may not be admitted to the operating room if the site/side is not marked.
- Consistent reminders, education, and systems in place.

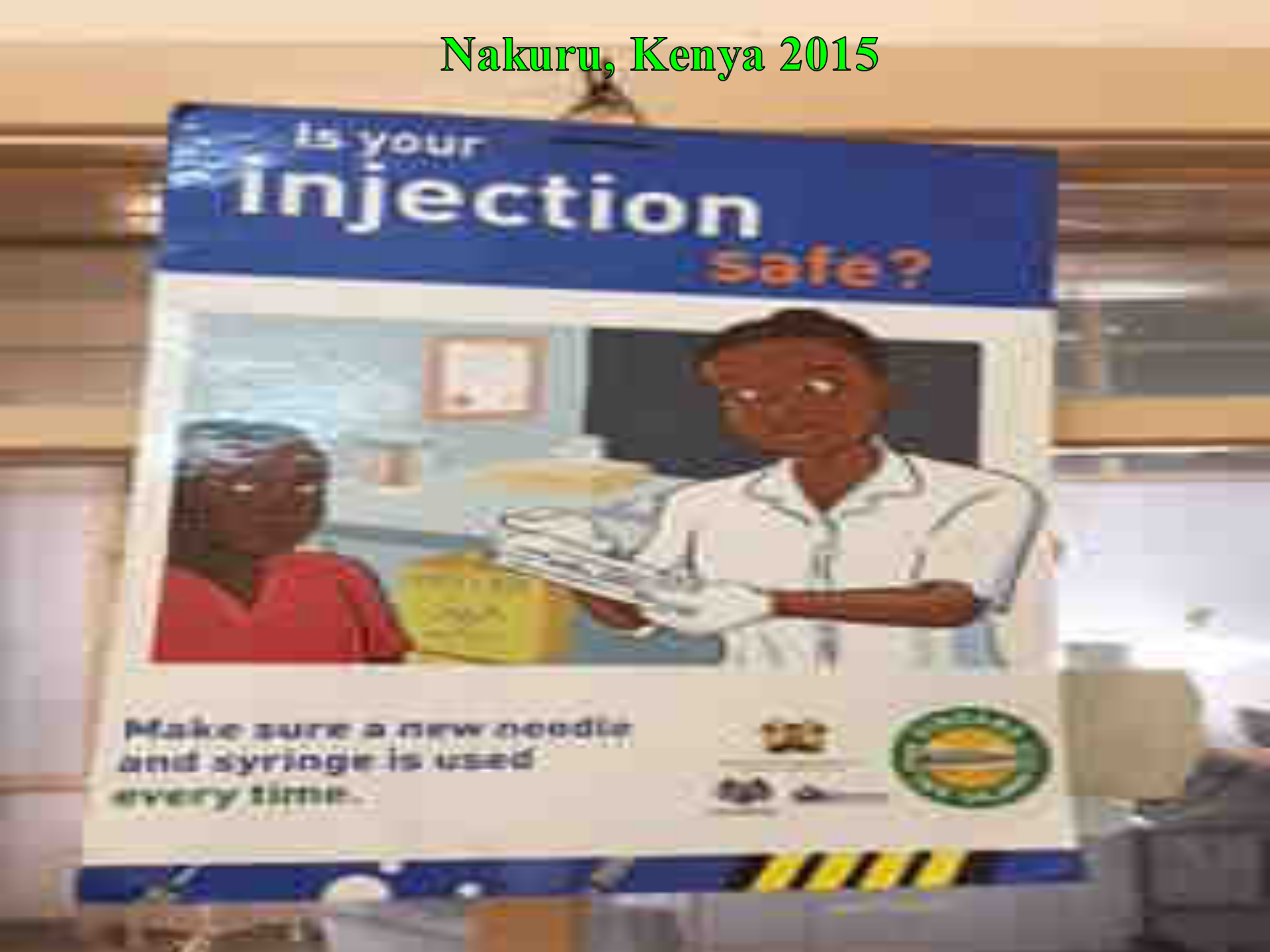

STOP!
WASH YOUR HANDS
BEFORE AND AFTER
EVERY PATIENT CONTACT



Kuwait City, Kuwait 2012

Sokoto, Nigeria 2012

Nakuru, Kenya 2015



World Health Organization

Surgical Safety Checklist

cpsi • icsp

Briefing - Before induction of anesthesia

Hand-off from ER, Nursing Unit or ICU

- ☐ All team members introduce themselves by name and role
- ☐ Anesthesia equipment safety check completed
- ☐ Patient information confirmed
  - Identity (2 identifiers)
  - Consent(s)
  - Site and Procedure
  - Site, Side, and Level marked
  - Clinical documentation
    - History and Physical, labs, biopsy, x-rays
- ☐ Review final test results
- ☐ Confirm essential imaging displayed
- ☐ ASA Class
- ☐ Allergies (drugs, latex)
- ☐ Medications
  - Antibiotic prophylaxis: Double dose?
  - Glycemic control
  - Beta blockers
  - Anticoagulant therapy (e.g., Warfarin)?
- ☐ VTE Prophylaxis
  - Anticoagulant
  - Mechanical
- ☐ Difficult Airway / Aspiration Risk
  - Confirm equipment / assistance available
- ☐ Monitoring
  - Pulse oximetry, ECG, BP, arterial line, CVP, Temperature; urinary catheter draining?
- ☐ Blood loss
  - Anticipated to be more than 500 ml (adult) or more than 7 ml/kg (child)
  - Blood products required and available
  - Patient grouped, screened, cross matched

Briefing - Before induction (continued)

- ☐ Surgeon(s) review(s)
  - Specific patient concerns, critical steps, special instruments / implants,
- ☐ Anesthesiologist(s) review(s)
  - Specific patient concerns, critical resuscitation plans, possible MH?
- ☐ Nurses(s) review(s)
  - Specific patient concerns, sterility indicator results, equipment / implant issues
  - Family and visitors expectations
- ☐ Patient positioning and support / Warming devices
- ☐ Communicable disease?
- ☐ PPE required? N95, isolation cart
- ☐ Expected procedure time / Postoperative destination
- ☐ Is this an oncology case?

Time Out - Before skin incision

- ☐ Surgeon, Anesthesiologist, and Nurse verbally confirm
  - Patient
  - Site, Side, and Level
  - Procedure
  - Antibiotic prophylaxis: Repeat dose?
  - Final optimal positioning of patient
- ☐ "Does anyone have any other questions or concerns before proceeding?"

Debriefing - Before patient leaves the OR

- ☐ Surgeon reviews with entire team
  - Procedure
  - Important intra-operative events
  - Fluid balance / management
- ☐ Anesthesiologist reviews with entire team
  - Important intra-operative events
  - Recovery plans (including postoperative ventilation, pain management, glucose and temperature)
- ☐ Nurse(s) review(s) with entire team
  - Instrument / sponge / needle counts
  - Specimen labelling and management
  - Important intraoperative events (including equipment malfunction)
  - any concerns re skin integrity?
- ☐ Changes to postoperative destination?
- ☐ What are the KEY concerns for this patient's recovery and management?
- ☐ Could anything have been done to make this case safer or more efficient?
- ☐ Incident report to be completed?

Hand-off to PACU / RR, Nursing Unit or ICU

University Health Network

Toronto General Hospital · Toronto Western Hospital · Princess Margaret Hospital

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Prospective Error Research

1. Quantitative study of error in elective surgical cases in one neurosurgeon's practice.
2. Qualitative studies of : i) patients' worry level about errors during craniotomy for tumour; and ii) how trainees handle serious errors.

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Prospective Quantitative Study

- Elective surgeries of one neurosurgeon since May, 2000.
- Error is liberally defined as “any act of omission or commission representing a deviation from perfection”.
- Cases are entered **prospectively** into a database with error type, severity, preventability, and impact.

Example – Minor Error

- Type = contamination
- Preventability = high
- Severity = minor
- Impact = none

Example – Major Error

- Type = technical or contamination
- Preventability = high
- Severity = major
- Impact = permanent

Purpose of Such a Study

- A prospective determination of frequency of errors is needed.
- Creating a culture where it is safe to talk about error will improve opportunities to learn about error, and thus improve morale and education among the team and help reduce errors.

Results

- 2494 elective cases to November 2017.
- 95% cranial (brain tumours); 5% spine.
- 86% had at least one error.
- 5545 total errors:

  median = 2/case

  mean = 2.2/case

Results (continued)

- Clinical impact: none or minimal in 56%
  transient in 41%
  permanent in 3%
  death in .1%
- Severity: 75% minor
  25% major
- Preventability: 80% preventable
  20% non-preventable

Results (continued)

- Clinical impact: none or minimal in 56%
  transient in 41%
  permanent in 3%
  death in 0.1%
- Severity: 75% minor
  25% major
- Preventability: 80% preventable
  20% non-preventable

Results continued

- Error type: technical 26%
  contamination 25%
  equipment failure 20%
  delay 14%
  nursing 5%
  anesthesia 5%
  management 3%
  communication 1%
  other 1%

Results continued

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  other 1%

Delays in the operating room: signs of an imperfect system

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Accepted for publication Aug. 25, 2009

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Division of Neurosurgery
University of Toronto
Toronto Western Hospital

Background: Delays in the operating room have a negative effect on its efficiency and the working environment. In this prospective study, we analyzed data on perioperative system delays.

Methods: One neurosurgeon prospectively recorded all errors, including perioperative delays, for consecutive patients undergoing elective procedures from May 2000 to February 2009. We analyzed the prevalence, causes and impact of perioperative system delays that occurred in one neurosurgeon's practice.

Results: A total of 1531 elective surgical cases were performed during the study period. Delays were the most common type of error (33.6%), and more than half (51.4%) of all cases had at least 1 delay. The most common cause of delay was equipment failure. The first cases of the day and cranial cases had more delays than subsequent cases and spinal cases, respectively. A delay in starting the first case was associated with subsequent delays.

Conclusion: Delays frequently occur in the operating room and have a major effect on patient flow and resource utilization. Thorough documentation of perioperative delays provides a basis for the development of solutions for improving operating room efficiency and illustrates the principles underlying the causes of operating room delays across surgical disciplines.

DOI: 10.3171/2014.5.JNS132341

A reduction in errors is associated with prospectively recording them

Clinical article

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Object. Error recording and monitoring is an important component of error prevention and quality assurance in the health sector given the huge impact of medical errors on the well-being of patients and the financial loss incurred by health institutions. With this in mind, assessing the effect of reporting errors should be a cause worth pursuing. The object in this study was to examine the null hypothesis that recording and publishing errors do not affect error patterns in a clinical practice.

Methods. Intraoperative errors and their characteristics were prospectively recorded between May 2000 and May 2013 in the neurosurgical practice of the senior author (M.B.). The error pattern observed between May 2000 and August 2006, which has been previously described (Group A), was compared with the error pattern observed between September 2006 and May 2013 (Group B).

Results. A total of 1108 cases in Group A and 974 cases in Group B were surgically treated. A total of 2684 errors were recorded in Group A, while 1892 errors were recorded in Group B. The ratios of cranial to spinal procedures performed in Groups A and B were 3:1 and 10:1, respectively, while the ratios of general to local anesthesia in the two groups were 2:1 and 1.3:1, respectively ($p < 0.0001$ for both). There was a significantly decreased proportion of cases with error (87% to 83%, $p < 0.006$), mean errors per case (2.4 to 1.9, $p < 0.0001$), proportion of error-related complications (16.7%

Prospective Error Research

1. Quantitative study of error in elective surgical cases in one neurosurgeon's practice.

2. Qualitative studies of : i) patients' worry level about errors during craniotomy for tumour; and ii) how trainees handle serious errors.

Qualitative Studies

- Interviews with 30 patients *before* brain tumour surgery (2004), and 30 patients *after* brain tumour surgery (2011).
- Interviews were transcribed and subjected to thematic analysis as per qualitative research methodology.

Results

- Worry level varies.
- Trust in the system is very important.
- Worry about the disease trumps worry about error.
- Talking about error is a good thing.

Canadian Journal of Neurological Sciences 2004
British Journal of Neurosurgery 2012

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Results

- Errors result from system problems.
- Residents are generally not comfortable talking to staff about it.
- Counselling services might help.
- The surgical culture may act as a barrier to trainees seeking help.

How Surgical Trainees Handle Catastrophic Errors: A Qualitative Study

James A. Balogun, MD, Alexa N. Bramall, MD, PhD,* and Mark Bernstein, BSc, MD, MHSc (Bioethics), FRCSC†*

*Division of Neurosurgery, University of Toronto, Toronto, Ontario, Canada; and †Division of Neurosurgery, Toronto Western Hospital, Toronto, Ontario, Canada

OBJECTIVE: Surgical trainees are often subject to the negative consequences of medical error, and it is therefore important to determine how trainees cope with error and to find ways of supporting trainees when catastrophic events occur. This article examines how trainees interpret catastrophic surgical outcomes and ways to provide support for trainees who have experienced catastrophic events.

DESIGN: Totally 23 semistructured interviews were conducted with surgical trainees. Interviews were conducted in English and subjected to modified thematic analysis.

SETTING: A tertiary care hospital in Toronto, Canada.

PARTICIPANTS: Interviews were completed with 23 surgery residents. Potential participants were recruited through communications via the Department of Surgery and

INTRODUCTION

Interest in medical errors rose significantly following the 1999 Institute of Medicine report, which stated that up to 100,000 deaths in the United States may have resulted from medical errors, making it the eighth leading cause of death.[1] This expectedly led to increased calls for improved patient safety from both the medical community and the general population.[2,3] However, medical errors are still common despite concerted efforts at preventing them.[4-7] Most of these errors are described as preventable, some are regarded as inevitable, and approximately 1% to 3% of medical errors results in adverse effects.[3,4,8,9]

A medical error can occur at any stage of patient's care and is defined as the failure of a planned action to be completed as intended or the use of a wrong plan to achieve

Journal of Surgical Education 2015

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Disclosure: A Paternalistic View from the "Old Days"

"The patient has no right to the full truth. He should only get so much as is good for him."

Oliver Wendell Holmes (1809-1894)
Dean of Harvard Medical School, and
father of the famous Supreme Court Judge.

A More Respectful View from the "Old Days"

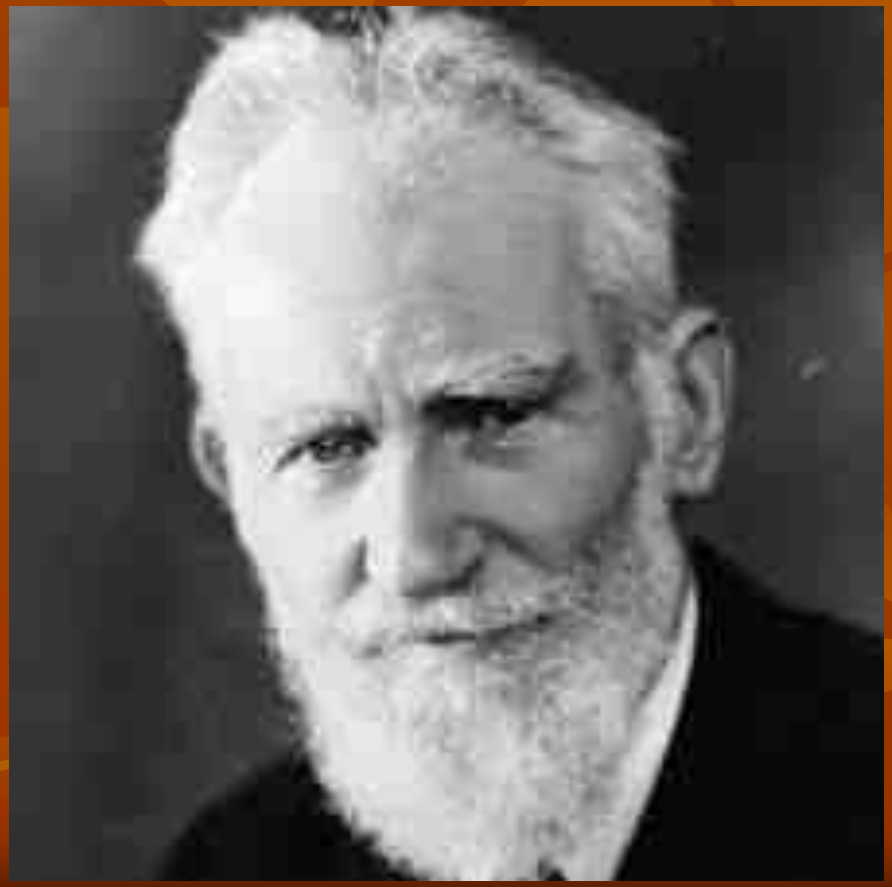
"Never be afraid of confessing your mistakes. It is cowardly not to do so and it may prevent others from falling into like error."

Joseph Lister (1827-1912)
The "Father" of antiseptic surgical technique.

“OK, honesty is the best policy. What’s the second best policy?”

“The single biggest problem in communication is the illusion it has taken place”

George Bernard Shaw



The Modern Approach

Legal and bioethical thought demands full disclosure to the patient of any error that any reasonable person would want to know about.

How About Peer Disclosure?

- M&M Rounds at one's own hospital.
- Presentation to groups outside one's hospital.
- Publication?

Wrong-side surgery: systems for prevention

Mark Bernstein, BSc, MD

Wrong-side surgery is probably the most dramatic, visible and devastating of all surgical errors. It is arguably the error most feared by surgeons. Recently, there was a prominently profiled neurosurgical case that received a lot of publicity, perhaps more than it might have because it occurred in a highly renowned medical institution in the United States.[1] In this paper I describe a case of a wrong-sided surgery as a platform to summarize the available literature with an emphasis on strategies to prevent such errors from harming patients.

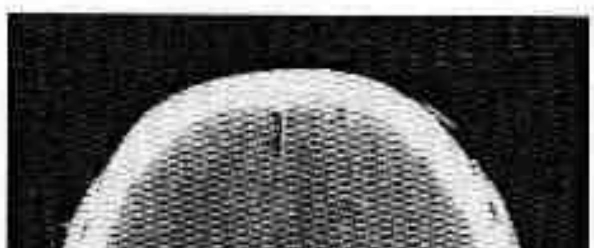
Case report

A healthy 71-year-old man presented with a subacute history of confusion and right hemiparesis. Computed tomography showed a large, chronic subdural hematoma in the left frontal region (Fig. 1). The patient was placed on the after-hours operating room waiting list and was called for around 1 am. An experienced senior resi-

to the patent's family by the surgeon and the resident.

The patient was noted to be deeply obtunded and hemiplegic on the right side; an urgent CT demonstrated a large acute hemorrhage into the left subdural space (i.e., the correct side) (Fig. 2). Urgent craniotomy on the left was performed to evacuate the clot. Postoperatively, the staff neurosurgeon had a long conversation with the family about the error and informed them that it would not likely have an impact on the patient's outcome. The complication was also discussed in detail. The patient's son specifically asked if the staff neurosurgeon was in the operating room at the time of the error. This question was answered honestly, and the nature of graded responsibility and delegation of responsibility within teaching hospitals was discussed. In a detailed discussion, the neurosurgeon, the senior resident and the junior resident dissected the possible causes of the error (and the complication) and considered potential methods of preventing such errors.

The patient recovered fully and 2 months after admission was neurologically intact and had a normal CT (Fig. 3). He was well 1 year later. At the time of this writing, neither the patient nor his family have initiated medicolegal action or made any formal complaint.



The drop attack

The nurse's voice at the other end of the phone contained some urgency. "You'd better come right back to the OR, Dr. Bernstein, the guys need you. We have a situation."

What could it possibly be? It was the last day of work before a much-needed summer holiday, and I had a worse-than-usual backlog of urgent brain tumour cases. The operating room manager had kindly found me some extra time on this particular Friday. So the last surgical patient before my vacation was a lovely 60-year-old lady who had severe headaches and weakness caused by a large brain tumour.

The actual surgery for removal of her rather bloody, delicately located tumour went very well; my residents and I were quite happy with the job. I left the OR for my trainees to close the patient; in our teaching hospital this was the norm. They were both excellent residents — talented doctors and good surgeons who were conscientious to a fault.

I returned to the OR within minutes. It was eerily quiet. Two young students who had been intently observing the surgery were now sitting quietly. The anesthetist avoided my gaze as I passed her. I approached the operating table, and the senior resident explained the situation with a forced calmness. The bone flap we had opened to expose and remove the tumour had been dropped on the floor. It was about the size of a playing card. The junior resident was preparing it with little plates and screws for reattachment to the skull when it slithered out of his hands. This good-natured young man was mortified. He didn't speak. His gaze was fixed on the patient's head.

Fumbles of this kind are an uncommon but well-recognized mistake in surgery; this was my second personal experience with a dropped bone flap in a 20-year career in which I have performed many thousands of surgeries. The senior resident rattled off the therapeutic options in his typically thorough fashion. In the old days we used to "cook" a contaminated bone flap in the autoclave, the same "oven" used to sterilize surgical instruments. But this practice was no longer acceptable to the infection control experts at my hospital. So we decided to fill the skull defect with metal mesh and surgical epoxy, materials made just for such a purpose. Thirty minutes later, final cosmetic touches with a high-speed drill had produced a beautifully contoured skull that was also harder than rock. The residents then closed the scalp. A turban-style head dressing was applied by the junior resident, and the patient immediately awoke in the OR, neurologically intact and speaking well.

I gathered the residents and students

DOI:10.1503/cmaj.050076

Uses of error

Surgical planning error: what's in a name?

Mark Bernstein

A woman was referred with a 1-year history of intractable left leg sciatica refractory to conservative therapy. Neurological examination revealed signs of nerve root irritation but no hard neurological deficit. MRI from another hospital showed a large disc herniation to the left side between the fourth and fifth lumbar vertebrae.

She was offered lumbar microsurgical discectomy. On the morning of surgery she was given a general anaesthetic, and placed in the knee-chest position. After the localising radiograph was done to establish the correct level, but before the skin was cut, the junior resident noticed that the name on the actual MRI sheet was not the patient's even though the radiograph folder had the patient's correct name on it.

An urgent MRI was done while she remained under general anaesthesia; this revealed a disc herniation to the left side at the level below (ie, between the fifth lumbar vertebra and the sacrum). Surgery was then done at the correct level with an excellent outcome and the patient remains pain-free 3 years later.

Many purists would argue that the patient should have been awakened after the error was discovered, but I felt we should avoid a wasted anaesthetic for her if possible. However that issue is peripheral to the main message here. The message is simply that busy clinicians must carefully examine the names on all imaging studies despite the fact that the imaging study the patient brings matches his/her clinical picture well. In this case the patient and her family were openly informed that two errors had been committed: (1) a mix-up by the hospital where the MRI was reported; and (2) failure of the neurosurgeon to confirm that the MRI in hand was indeed that of the patient.

Division of Neurosurgery, Toronto Western Hospital, Toronto, Ontario M5T 2S8, Canada (M Bernstein MD)

Truth, like surgery, hurts but it cures.

Han Suyin

The 3 “A’s” of a Good Doctor

- **A**vailability
- **A**ffability
- **A**bility

The 3 "A's" of a Good Doctor who has Erred

- **A**cknowledge the error to yourself and others.
- **A**pologise to the patient.
- **A**cquire knowledge to prevent your making the same mistake again.

“Surgical knowledge of value is built more on the mistakes than on the successes of past experience.”

Harvey Cushing (1869-1939)

The “Father” of modern Neurosurgery

May we suggest that…

- It is ethically acceptable for health care workers to make errors, but it is unethical to not learn from our errors and it is our moral duty to study error.
- It is health care workers' moral duty to disclose major errors.
- It is patients' and society's moral responsibility to understand and forgive.

To err is human, to forgive is…

Human!