
Intraoperative Technical Errors in Hand Surgery: Prevalence and Potential Root Causes

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Abstract: Despite all efforts made by healthcare systems around the world to prevent medical errors from occurring, their incidence rates are still increasing, prompting the World Health Organization (WHO) to describe it as an epidemic problem. Realizing it is a thorny, sensitive subject, difficult to reach a consensus on, and despite the scarcity of sources related to hand surgery in particular, as well as the reluctance of some individuals and official institutions to provide information about it, we decide to tackle the issue because of its importance, especially since most of these errors are preventable and avoidable, by analyzing 245 cases detected or referred to the hand clinic in Benghazi between January 2020 and December 2021, who were suffering iatrogenic adverse effects related to previous surgical interventions. After excluding the non-surgical errors, we found that the percentage of intraoperative technical errors in hand surgery was 39.1%, with inadequate procedures being the most common at a rate of 65.6% and the lack of appropriately efficient equipment being the reason for 32.4% of these errors. To conclude, practical special training in hand surgery and the discovery of the root causes of these errors are the best ways to reduce them to a minimum.

Keywords: Iatrogenic Complications, Technical Errors, Malpractice, Patient Safety

1. Introduction

The increasing number of malpractice cases and claims of medical errors can be attributed to increased citizens' awareness of their rights to better health care, or to the unfortunate actual increase in the incidence of these errors.

Despite our preference for the first, we cannot rule out the possibility of the second, which is the hypothesis adopted for our research.

Because of the sensitivity of the subject and its association in public opinion with the level of professional skills and dexterity, some surgeons are reluctant to voluntarily reveal their lapses and outright mistakes, while others may adopt the practice of safe medicine at the expense of patient care for fear of their reputation and to avoid administrative penalties and legal prosecutions.

Hence, the lack of information by individuals and some official institutions may explain the scarcity of sources about technical errors related to hand surgery in particular and the fact that most surgical errors are usually discovered when their bad results appear and the patient seeks help or is

referred for the opinion and advice of specialists.

However, despite all difficulties, we are trying to shed light on this worldwide growing health problem, aiming to approach its magnitude in our hospitals and to analyze some possible root causes of its occurrence through the analysis of 245 cases of surgical errors related to hand surgery that were discovered among patients referred to the hand surgery unit at Aljala Hospital or who attended our outpatient hand clinics in Benghazi for correction of significant adverse events following previous surgical managements.

In this humble contribution, we acknowledge the deficiency that the examples presented in this study and others represent only part of the painful reality represented by the epidemiological issue of the medical errors, Where always there are lapses that pass peacefully unnoticed and others may have temporary negative effects, wherein both the body takes care of to treat as possible or adapt to what settles, and another that the patient accepts with conviction or out of desperation, and many are settled by amicable, customary or judicial means.

2. Methods

Data for this analytic study were gathered from the admission records and operation department records at Al-Jala Hospital, Ebn-Sena and the Libyan International Hospital, as well as the hand out-patient archives at Aljayar Clinic and Mays Medical Center, between January 2020 and December 2021.

According to the discharge papers, the personal information and dates of admission and discharge, of those who attended our hand surgery clinics for consultation or treatment of adverse events after previous surgeries were collected.

The cause of the original problem, the initially given diagnosis upon admission, the final diagnosis, the time, type, and duration of previous surgeries, as well as the type of anesthesia and whether or not a tourniquet, TV monitor, or loupes have been used, the surgeon's rank (specialist, senior registrar, registrar, house officer, or trainee)

Upon presentation, the presenting complaint, clinical

examination results, and relevant investigation results were all collected.

The intended correction is explained to the patient or family, and a consent document is signed.

Finally, at their last follow-up visits, a questionnaire was distributed to determine the patient's or family's satisfaction with the result of the correction's outcome (very satisfied, satisfied, dissatisfied).

To facilitate handling the problem, the surgical errors were classified as preoperative, intraoperative, and postoperative errors, which is adopted as the basis of our analysis.

3. Exclusion

Excluded are the preoperative and postoperative errors [40.5% and 20.4%, respectively], as well as errors that the patient was unaware of that were detected accidentally during the clinical examination or X-rays. However, errors that the patient or family is aware of, even if they were accepted, are included. (Figures 1-3)

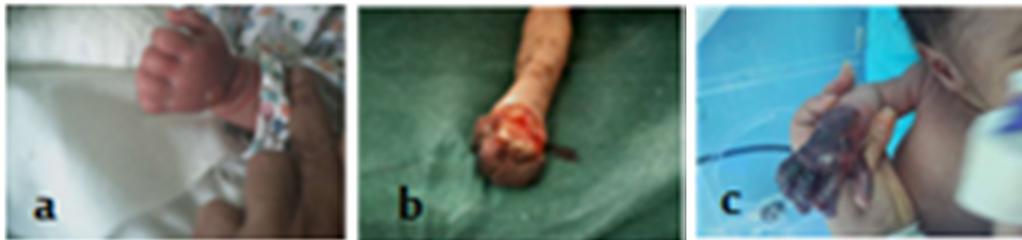


Figure 1. Malpractice cases, including (a) tourniquet injury, (b and c) extravasation, and intraarterial injection.

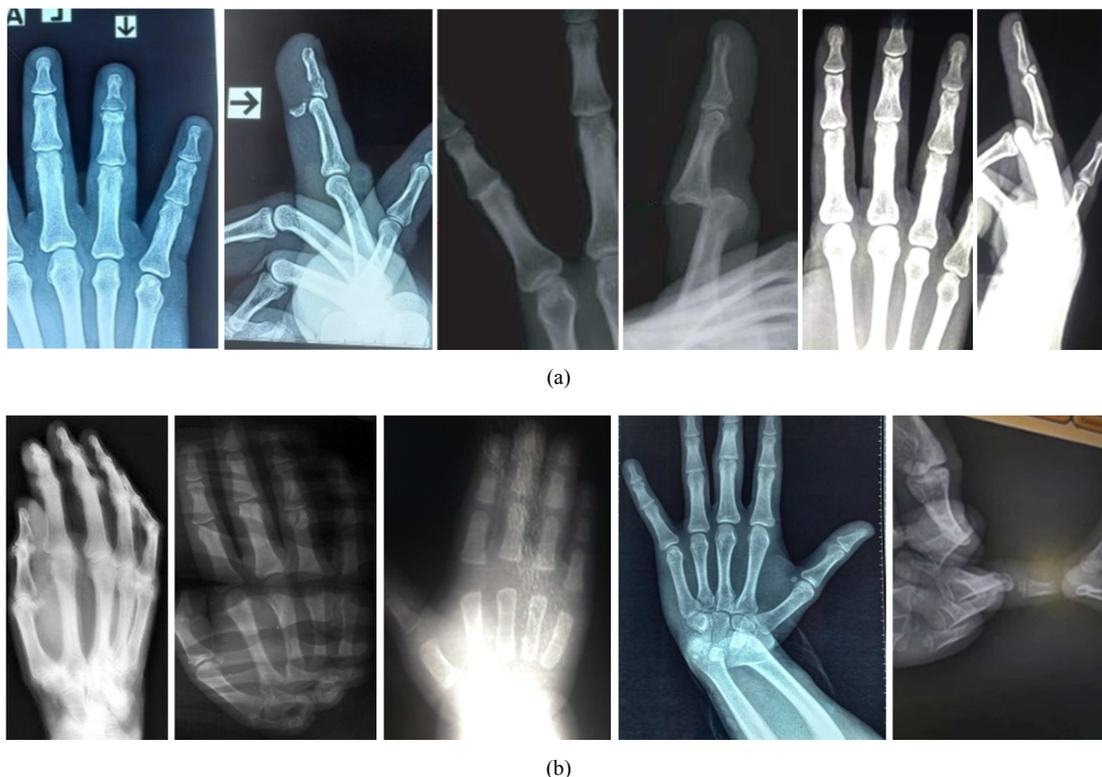


Figure 2. (a) demonstrates how misleading a single X-ray view can be; (b) shows that reliance on non-standard X-ray views can be a cause of error.



Figure 3. Incorrect or poor immobilization can be another example of preoperative as well as postoperative errors.

4. Results and Discussion

The rising number of medical malpractice claims can be attributed either to the commendable awareness of citizen's rights to the best possible health care or to the unfortunate, real increasing incidence of these errors.

However, with the spread of knowledge channels and media interest, the possibility of being both cannot be ruled out. [1-3]

Although we prefer the first, we cannot ignore the possibility of the second, which is the hypothesis we used in this research.

Recognize that it is a complex issue that is hard to reach a consensus on even among the field experts, not to mention the constant debate about it in court corridors with lowers and those concerned with patient safety.

Whereas some hardliners see tightened penalties for perpetrators and victim's compensation as an effective way to reduce the phenomenon. [4, 5]

Healthcare providers believe that harsh penalties will have little effect or impact. Especially given that the vast majority of errors are ultimately the result of system deficiencies or failure of strategy, which although beyond the clinicians control may lead them to make errors. [6, 7]

On the contrary, they will force surgeons to practice defense medicine to protect themselves at the expense of

patient care and evade honest documentation and voluntary declaration of their mistakes to learn from them and avoid repetition. [8]

Therefore, addressing this increasing public health problem, [10-18] it is necessary to understand its physical, psychological, social, and economic consequences on both the victim and the error perpetrator -who is sometimes referred to as the second victim-, [6, 9] which has increased from (94,000) errors in 1990 to (142,000) errors in 2013, with a death rate of 230,000 to 400,000 each year and an economic cost estimated in billions of dollars annually, What prompted the World Health Organization (WHO) to describe it an "endemic concern". [19]

Our contribution includes the report of intraoperative technical errors in hand surgery collected from 245 cases of discovered adverse events related to hand hand surgery during the study time limits.

5961patients were admitted to Aljala Teaching Trauma Hospital of Benghazi for surgical, conservative, and observation care during the years 2020 and 2021.

3267 (54.8%) of these involved orthopedic injuries, and the hand surgery component was 755 (41.2%).

After exclusion of the pre and postoperative errors, errors that the patient was unaware of, and 14 missed cases out of the 245 discovered iatrogenic adverse events related to hand management, we left with 96 cases of outspoken intraoperative technical errors to investigate, which is 39.1% of the detected errors in relation to hand surgery.

As an art and science, hand surgery, in addition to personal abilities, requires solid training to refine skills and the optimal use of delicate equipment, which may explain these high rates, especially when practiced by unqualified surgeons.

In decreasing order of frequency, the patterns of surgical error were as follows:

1) Inadequate procedures were found in 63 cases at a rate of 65.6%, with the majority of them being poor reduction and/or loose fixation. (Figure 4, a-g)



(a)



(b)

(c)



(d)



(e)



(f)



Figure 4. (a-g): Weak reduction and non-rigid fixation are common examples of insufficient procedures' intraoperative errors.

Another example of "inadequate" procedures is the retention of non-functioning bony remains during amputations, as shown in Figure 5 (a-b).



Figure 5. (a-b) Retained nonfunctioning bone segments are frequent indications for revisions due to the inconvenience they usually cause and the possibility of penetrating the skin.

2) Intraoperative inflicted injuries by the surgical team to the patient, themselves, or their coworkers were reported and detected in 20 cases (20.8%) (Figure 6, a-c).

Three surgeons reported self-inflicted needle-prick injuries during surgery.

Two patients suffered ulnar nerve injuries, one while being dissected for nerve transposition in cubital tunnel syndrome and the other after the ulnar vessels were ligated to control

bleeding.

Five partial median nerve injuries occurred during carpal tunnel release.

Three injuries involved the radial nerve's sensory branch: two after attempts to release the first dorsal compartment for de-Quervian disease and one after dorsal wrist ganglion excision.

Four tendon injuries occurred: two during dorsal wrist ganglion excision, one in an attempt of first annular pulley release for trigger finger, and one during corrective osteotomy of a malunited fracture of the distal radius.

Two joints were destroyed by Kirchner wire's fixation, in addition to one diathermy burn, due to the mistaken connection of mono-polar diathermy.

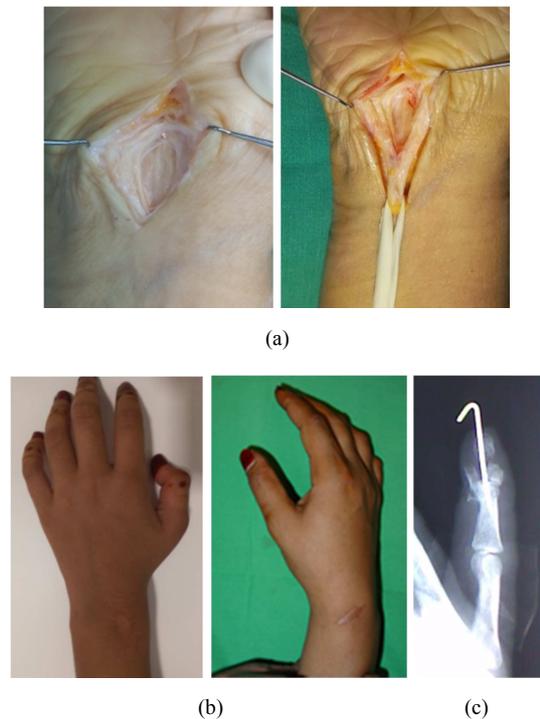


Figure 6. (a): Median nerve injuries during surgical decompression for carpal tunnel syndrome. (b): Iatrogenic injury of the EPL tendon following an attempt of the 1st dorsal compartment in de-Quervian disease. (c): Iatrogenically shattered base of the distal phalanx in an attempt at basal fracture fixation.

3) Wrong decision, nine cases (9.3%), two cases of incorrect exposure, three cases of improper flap design, one closure eponychial fold, and three mismatched tendon connections. (Figure 7, a, b)



Figure 7. Wrong approaches for proximal phalanx neck fracture fixation (a) and for mallet finger repair (b), wrong flap design (c), iatrogenic closure of the eponychial fold (d), disturbing the fingers kinematics by suturing the EDC to FDP against the fingers' stump area (e), misconnected EPL to ECR, and the EDM to ECU tendons (f and g).

4) Excessive procedures (4.1%), represented by excessive fixation of four fractures (Figure 8, a-e)

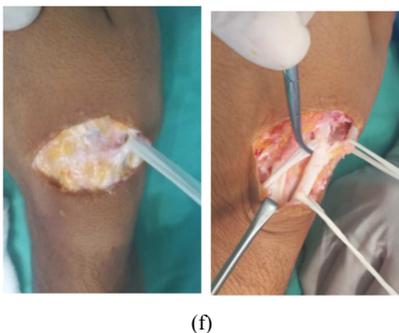
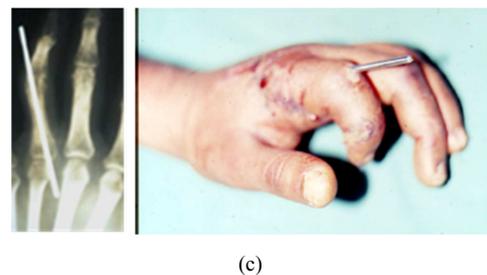
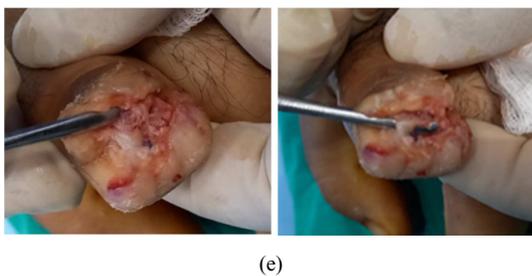
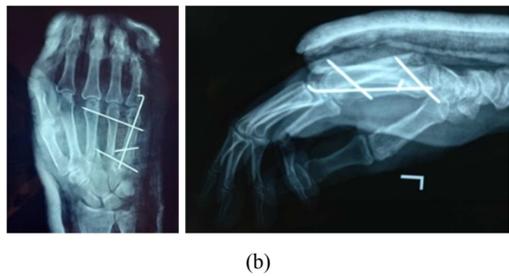


Figure 8. (a-e): shows examples of excessive procedures that could result in unintentional soft tissue injury, needless joint damage, and mechanical blockage.

In general, finishing the surgical procedures in a way less or more than should be, except for some minor differences, inadequate treatment leads to almost the same problems as the excessive treatment does.

Both may lead to disastrous complications such as; the complexity of procedure, predispose to injury, infection, delay or non-healing, scarring, deformity, and functional impairment. Table 1 (68.0%) of the cases (64) were operated in an emergency, (70.2%) under general, and (29.7%) under local anesthesia.

Table 1, The adverse effects of inadequate treatment vs excessive treatment.

Inadequate treatment	Excessive treatment
Wound gaping	Skin necrosis
Haematoma collection	Edema
Bleeding	Ischemia
Redisplacement	Distraction
Scarring	Scarring
Contractures	Contractures
Deformity	Deformity
Delayed or non healing (loosening)	Delayed or non healing (mechanical block)
Foreign body reaction	Foreign body reaction
Infection	Infection

The standard arm tourniquet was used in 62.7% of the cases, while TV monitoring was used in only (21) 22.3%, and loupes magnification was not used in any of them.

Because extensive hand injuries and diseases are typically referred to hand surgeons or specialists, these errors typically occur following treatment of simple rather than complex procedures such as closed fractures, de-Quervian disease, CTS, or ganglion excision. [20]

Although the majority of cases are handled as emergencies by junior doctors with less than three years of experience, a sizable proportion (34%) are handled by more experienced surgeons.

The results were consistent with a study of 430 medical malpractice cases from 1989 to 2019, showing higher risk with surgeons without a hand surgery degree, [21] probably because of the comprehensive skills that subspecialty surgeons acquired through effective training to handle this type of anatomically compact, dynamically complex, and functionally extensive organ surgery.

Especially since the vast majority of errors are ultimately a result of either system failure or strategy failure, which is not only beyond the practitioner's control but may lead them to make mistakes, and as these are modifiable factors, it is necessary to take action on them.

The age and sex variables in our findings showed no statistically significant differences. The ages range from hours to 74 years, and both sexes may be affected in roughly equal amounts.

Our analyses also revealed a higher percentage of technical errors in government hospitals (78.7%) than in private hospitals because surgeries in the private sector are usually performed by senior doctors, which is consistent with the findings of other studies' results. [22-25]

While The American Academy of Orthopaedic Surgeons (AAOS) reported that lack of suitable and effective

equipment is responsible for 29% of intraoperative errors in hand surgery, [26] it accounted for 32.4% of these errors in our case, forcing the surgeons to make modifications or to use less effective alternatives, which increase the possibility of making mistakes. [1, 2]

But in most cases, whether the procedure was insufficient or over, or injuries inflicted, poor performance is at best a common factor, among the possible root cause list of surgical errors as follows:

- 1) Lack of surgeon's training.
- 2) Lack of standardized rules and control.
- 3) Lack of equipment.
- 4) Rush to complete cases.

79 errors required one or more corrective interventions (82.2%).

Finally, after surgical intervention to correct these errors, 12 (15.1%) patients were dissatisfied, 39 (49.3%) were satisfied, and 28 (35.4%) were very satisfied and returned to normal life.

Which means that whatever reform efforts were successful, will not be sufficient to satisfy at least 15.1% of these injuries.

5. Conclusion

This study concluded that appropriate hand surgery training reduces the risks of technical errors during surgery, and it is critical to establish root-cause analysis committees in our hospitals and rely on their reports to reduce errors to the greatest extent possible.

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