

Compartment Syndrome of the Hand Secondary to Intra-Compartmental Injection of Intravenous Drugs; Case Report and Review of the Literature

J Samona, B Kemker, D Mayor, A Srivastava, M Sardelli

Citation

J Samona, B Kemker, D Mayor, A Srivastava, M Sardelli. *Compartment Syndrome of the Hand Secondary to Intra-Compartmental Injection of Intravenous Drugs; Case Report and Review of the Literature*. The Internet Journal of Hand Surgery. 2015 Volume 7 Number 1.

DOI: [10.5580/IJHS.35194](https://doi.org/10.5580/IJHS.35194)

Abstract

This is the first presentation in the medical literature to display an acute compartment syndrome of the hand, originating from infiltration of intravenous drugs into the intra-compartmental space of the 1st web dorsal space and thenar eminence of the hand. The function of the human hand touches almost every aspect of our daily activities, and loss of this function is devastating.

INTRODUCTION

This is the first presentation in the medical literature to display an acute compartment syndrome of the hand, originating from infiltration of intravenous drugs into the intra-compartmental space of the 1st web dorsal space and thenar eminence of the hand. The function of the human hand touches almost every aspect of our daily activities, and loss of this function is devastating

Case reports and case series in the past have reported compartment syndrome in the upper extremity as a result of IV drug administration (1). A smaller number of cases have been reported regarding the use of drugs injected directly into the arm, forearm, or wrist, leading to arterial and or venous injury and constriction, subsequent thrombosis, and compartment syndrome (2, 3, 4). Multiple incidences have been documented regarding compartment syndrome caused by extravasation of fluid into the extracellular space or within the compartments of either the hand or forearm, as seen in the setting of administration of chemotherapy, intravenous drugs and fluids (1, 5, 6, 7).

CASE REPORT

A 32 year old female with an extensive history of IV drug abuse reported to the hospital emergency department with complaints of left hand pain. At the time of the initial interview, she admitted to injecting heroin into the region

surrounding the first dorsal interosseous web space region and thenar eminence. Due to stricture of venous structures elsewhere in the body from long term IV drug administration, the subject was unable to find readily available access in order to inject herself. She resorted to injecting herself in the 1st web space of the hand and thenar eminence, but claims that she did not notice the regular return of blood in her needle she was accustomed to with injections elsewhere in her body with direct venous access. Per patient accounts, a high volume of drug was injected at the time of attempted intravenous access. After a few hours status post injection, she claims she reported to the hospital secondary to hand pain. After orthopedic evaluation it was noted the patient was experiencing minimal paresthesias in the distribution of the first and second digits. There was slightly increased firmness to the first dorsal interosseous compartment as well as the thenar compartment, as compared to the remaining compartments on the ipsilateral hand, as well as corresponding compartments on the contralateral unaffected hand. The subject complained of minimal pain with passive range of motion of the first and second digits, although the remaining digits were relatively painless with motion. She was guarding with active range of motion at the hand, most notable at the first and second digits. Capillary refill was brisk to all the digits of the hand, and the compartments of the forearm were soft to palpation at this time. The patient was grossly neurovascularly intact,

Compartment Syndrome of the Hand Secondary to Intra-Compartmental Injection of Intravenous Drugs; Case Report and Review of the Literature

and there were no overt signs of compartment syndrome at the time. The decision to admit the patient for observation and serial neurovascular checks was made. The effected upper extremity was elevated and over the course of a few hours the orthopedic team serially re-evaluated the patient. Venous and arterial ultrasound studies of the effected extremity were negative for thrombosis or vascular compromise.

Over the course of a couple hours the pain increased, the 1st dorsal compartment as well as the thenar muscle compartment became increasingly tense, capillary refill in the first and second digits became increasingly sluggish, and numbness in the fingers became increasingly severe, and pain with movement was out of proportion to what would be expected. The signs and symptoms were in large part isolated to the first and second digits. There was a high clinical suspicion of an evolving compartment syndrome at this time, and intra-compartmental pressures via a Stryker Needle were ascertained on the 1st dorsal interosseous web space (measuring 56 mmHg) and thenar compartment (measuring 58 mmHg). Her blood pressure at the time of intra-compartmental readings was 121/72. The diagnosis of compartment syndrome was made and the patient was taken to the operating suite in an emergent fashion for decompression via fasciotomy.

In the operative suite during the decompressive procedure, it was noted that the musculature of the patient's 1st dorsal web space was viable, however demonstrated evidence for increased pressure within the compartment intra-operatively. There was no vascular damage noted to the structures of the hand or forearm noted during the procedure, which has been noted in the past with intra-arterial injection of IV drugs or laceration of a vessel which may incite a compartment syndrome. Electrocautery to the musculature of the thenar musculature and 1st dorsal web space revealed sluggish musculature contraction, however viable muscle. This likely represented partial ischemia to the musculature secondary to the results of compromised vascular flow seen in the setting of compartment syndromes. Similar testing via electrocautery revealed adequate muscular contraction when performed elsewhere on musculature of the effected upper extremity. It should be noted, clear fluid oozed from surgical wounds overlying the 1st web space and thenar musculature. This likely represented extracellular fluid, as well as the previously injected heroin. The entire hand and forearm was decompressed in the operative suite at the time of surgical

intervention. Approximately 6 months from the procedure, the patient's hand function returned to essentially normal function.

In all the aforementioned documented cases, symptoms of compartment syndrome included the entire forearm and/or entire hand. This is the first documented case in which compartment syndrome has been localized to 2 specific compartments of the hand as a result of direct intra-compartmental injection of drugs intended for venous administration. It is hypothesized the attempted IV administration of heroin into the hand infiltrated the hypothenar and 1st dorsal interosseous compartments, resulting in increased intra-compartmental pressures, decreased venous return, subsequent decreased arterial flow, edema, extravasation of extracellular fluid, and resulting compartment syndrome. Previous cases have been presented with extravasation of fluid from attempted intravenous access into the arm, forearm, or dorsum of the hand. Never has it been documented the compartment syndrome was localized to 2 specific compartments as a result of IV drug administration. The signs and symptoms of compartment syndrome were only clinically apparent in regards to the first and second digits, which correlates to the involvement of the aforementioned compartments. The reactions to electrocautery demonstrated likely partial ischemia to the musculature of these compartments, while normal responses were ascertained with electrocautery to adjacent compartments. It is unlikely injection into the artery or vein lead to thrombosis and/or vasospasm which would have induced a compartment syndrome. This is proven in the normal vascular studies, and no evidence of vascular damage upon evaluation in the operative suite. Such damage has been noted in previous documented cases of compartment syndrome in which vascular damage indeed occurred. Aneurysmal like formation or gross damage to vascular structures has been documented in the past. The patient claimed she did not experience any drawback of blood into the syringe when she injected, adding further credence to the proposal the vascular structures were not directly compromised by the injection of heroin.

This case report demonstrates a unique presentation of a thoroughly studied pathology, which makes this particular presentation exceedingly rare. This represents a clinical situation that highlights the importance of a thorough neurovascular examination of the entire upper extremity as individual compartments of the hand, wrist, and forearm can

be affected in the setting of injection injury. Occasionally, as seen in this case, the entire hand, wrist, or forearm will not be affected but rather selected compartments in these regions. Due to the devastating effects of compartment syndrome leading to permanent debility and limb loss, this case is of utmost importance. There are numerous means in which compartment syndrome may arise, and it is vital the astute orthopedic surgeon be well aware of these circumstances in order to make a timely diagnosis and provided appropriate care to avoid the morbidity associated with this devastating pathology.

References

1. Ouellette EA, Kelly R. Compartment syndromes of the hand. *J Bone Joint Surg Am.* 1996;78(10):1515-22.
2. Scott RN, Going J, Woodburn KR, et al. Intra-arterial temazepam. *BMJ.* 1992;304(6842):1630. <http://www.sciencedirect.com/science/article/pii/S1533316706000744>. Accessed January 17, 2015.
3. Compartment Syndrome of the Hand Following Intra-Arterial Injection of Heroin. *Journal of Hand Surgery (British and European Volume).* 1999;24(3):366. Available at: <http://link.springer.com/article/10.1007/BF03027961>. Accessed January 17, 2015.
4. Mabee JR, Bostwick TL, Burke MK. Iatrogenic compartment syndrome from hypertonic saline injection in Bier block. *J Emerg Med.* 1994;12(4):473-6.
5. Quigley JT, Popich GA, Lanz UB. Compartment syndrome of the forearm and hand: a case report. *Clin Orthop Relat Res.* 1981;(161):247-51.

Author Information

Jason Samona, DO, Orthopedic Surgery

McLaren Regional Medical Center, Orthopaedic Surgery Department
Flint, MI
Jasonsamona@yahoo.com

Bernard Kemker, MD, Orthopedic Surgery

McLaren Regional Medical Center, Orthopaedic Surgery Department
Flint, MI
bpkemker@gmail.com

David Mayor, MD, Orthopedic Surgery

McLaren Regional Medical Center, Orthopaedic Surgery Department
Flint, MI

Ajay Srivastava, MD, Orthopedic Surgery

McLaren Regional Medical Center, Orthopaedic Surgery Department
Flint, MI

Mathew Sardelli, MD, Orthopedic Surgery

McLaren Regional Medical Center, Orthopaedic Surgery Department
Flint, MI