Tumescence in Cadaveric Dissection: A Teaching Perspective

Mario G. Loomis, Jonathon H. Hines, and Amberly M. Reynolds

Corresponding Author: Mario.Loomis@shsu.edu

HAPS Educator. Vol 26 (3), pp. 33-37. Published December 2022.

https://doi.org/10.21692/haps.2022.005

Loomis MG, Hines JH, and Reynolds AM. (2022). Tumescence in Cadaveric Dissection: A Teaching Perspective. *HAPS Educator* 26 (3): 33-37. https://doi.org/10.21692/haps.2022.005

Tumescence in Cadaveric Dissection: A Teaching Perspective

Mario G. Loomis, MD, Jonathon H. Hines, MBA, Amberly M. Reynolds, PhD, MS
Department of Clinical Anatomy, Sam Houston State University College of Osteopathic Medicine
925 City Central Ave, Conroe, TX 77304
Corresponding author: Mario.Loomis@shsu.edu

Abstract

Tumescence in cadaveric dissection involves the introduction of fluid into interstitial spaces to assist in the separation of natural tissue planes and the preservation of delicate structures. With a hand surgeon's perspective, the senior author brought this technique into the cadaver lab. The infusion helped transform desiccated and adherent tissue into hydrated, mobile tissue, more like that of a living person. The use of the technique is described for dissecting the palms and soles, and the resulting dissections are demonstrated. https://doi.org/10.21692/haps.2022.005

Key words: tumescence, anatomy, cadaveric dissection, dissection facilitation

Introduction

Having used tumescence during surgery for many years, the senior author (MGL) has brought this technique into the cadaver lab to help dissect more difficult areas such as the palms of the hands and soles of the feet. The word, *tumescence* simply means swelling of tissues. When used in the context of surgery or dissection technique, it refers to the active introduction of a tumescent fluid into interstitial spaces in preparation for dissection.

Historically, prior to the development of intravenous catheters, tumescence was the primary means by which fluid resuscitation was carried out in patients who could not take fluids by mouth. The term, *clysis*, was, and still is, used to describe this sort of tumescence. More recently, this method of hydration has been revisited in cases when intravenous fluids would be difficult, such as in nursing home patients who were unable or unwilling to maintain an IV (Duems Noriega and Arino-Blasco 2014; Hussain and Warshaw 1996). Clysis has also been used in the treatment of burns. Fluid is injected beneath the burn eschar delivering active agents – dilute iodine and a vasopressor – to decrease the risk of blood loss, infection, and sepsis (Allorto-Bishop et al. 2015; Sinha et al. 2003). Tumescence has been used during facial surgery, where the fluid assists in separation of planes, and delivers active agents for anesthesia and vasoconstriction (Jones and Grover 2004). During a mastectomy, tumescence can assist with a less traumatic separation of tissue planes and the delivery of an active agent for vasoconstriction. Improved flap elevation and preservation has been reported with tumescence (Ng et al. 2019).

In the cadaver lab, tumescence delivers an active agent – the wetting solution – into all tissue planes instead of just being sprayed onto the surface. And most importantly, as during mastectomies and facial surgery, it can facilitate the identification of natural tissue planes, transforming what are often desiccated and adherent planes to more hydrated and mobile planes akin to those in a living patient.

Methods

Prior to the beginning of dissections in more challenging areas such as the hand and feet, tumescent fluid was injected into the interstitial tissues of the cadavers using a 30cc syringe and a blunt-tipped cannula (Fig. 1A). Alternately, a similar infusing cannula with a luer lock connection can be used with a 10cc or 20cc syringe. The tumescent fluid consisted solely of the wetting solution used in our anatomy lab: a mixture of 80% water, 18% propylene glycol, 0.4% phenoxyethanol, and 6oz. Sanisol 7® detergent disinfectant (Trinity Fluids) per gallon of solution. The entry site was created with scissors or the tip of a mosquito clamp. The tip of the cannula was inserted into the space immediately beneath the dermis and advanced one to two centimeters (Fig. 1B). It was then further advanced while injecting the tumescent fluid such that there was little to no resistance to the cannula. The cannula was used to gently find the natural tissue plane as the path of least resistance. More tumescent fluid was injected while withdrawing the cannula. This provided additional hydro-dissection (Figure 1C).

The plane was opened with blunt-tipped dissecting scissors, such as curved Mayo scissors, and the skin freed up and kept intact for surface orientation and a protective cover (Figure 1D).

continued on next page

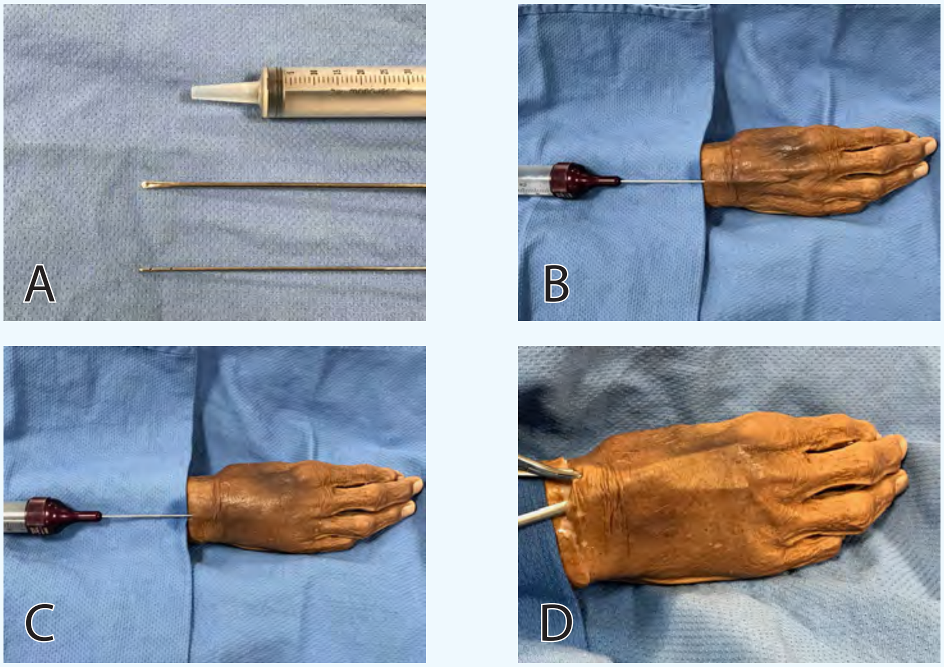

Figure 1. *Infusion of tumescent fluid. A. Blunt-tipped cannula with multiple perforations for fluid infusion. B. After creating a small opening with the tip of a mosquito clamp, the cannula is introduced into the space immediately below the dermis. C. The tumescence expands along the natural tissue plane, aiding the preliminary dissection. D. Curved blunt-tipped dissection scissors are used to free up the skin immediately beneath the dermis.*

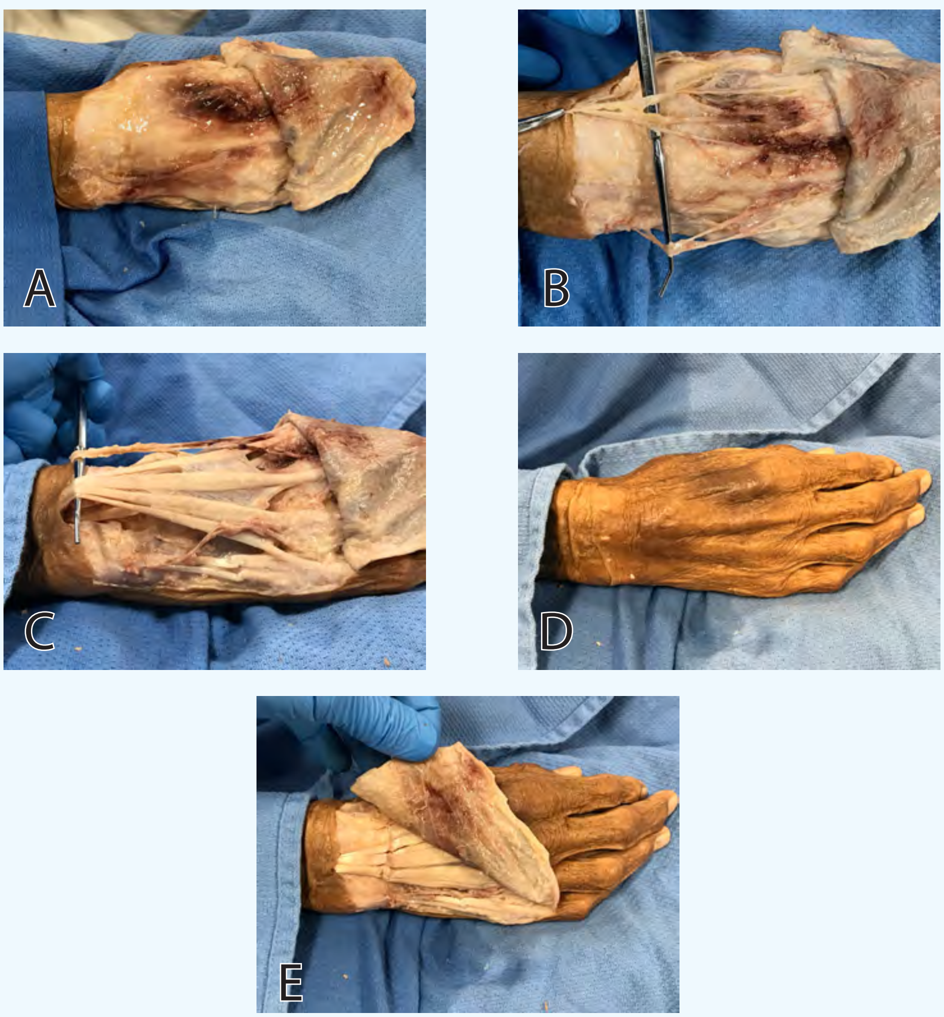

Figure 2. *Dissection following tumescent fluid infusion. A. After cutting along each side with scissors, the skin is kept intact and reflected. B. After the structures in the superficial layer are traced and preserved, the next layer is readily accessible. C. The tumescence helps with deeper planes as well, allowing for the rapid identification of structures and relationships. D. The preserved skin provides a reliable barrier to desiccation. E. The intact skin allows for correlation of surface anatomy with underlying structures.*

continued on next page

As the skin was reflected, finer structures that are often adherent to the skin, such as cutaneous nerves, readily dropped down thanks to the increased interstitial fluid (Figure 2A). Blunt spreading with a curved mosquito clamp quickly revealed cutaneous nerve branches (Figure 2B). Deeper structures were separated and cleaned in a similar fashion (Figure 2C) and the preserved skin was used as a natural cover to help prevent desiccation (Figure 2D). Furthermore, replacing the reflected skin also allowed students to readily correlate surface anatomy with underlying structures (Figure 2E).

The same technique was also used in the more challenging palms of the hands. The palmar skin was kept intact, as on the dorsum, and delicate nerves and vessels were likewise dropped down from the skin with scissor dissection (Figure 3). Additional tumescence was infused as needed to maintain a hydrated field similar to that in the living hand.

Benefits

From the senior author's perspective as a hand surgeon, tumescence in the cadaver lab helps transform the challenging post-mortem contraction and adherence of tissue planes in the cadaver to more life-like conditions. This allows for a more pleasant and thorough dissection of finer structures (Figure 4). Very fine structures, such as the nerve extending to a lumbrical, can be quite easily identified and preserved in the moistened environment (Figure 5).

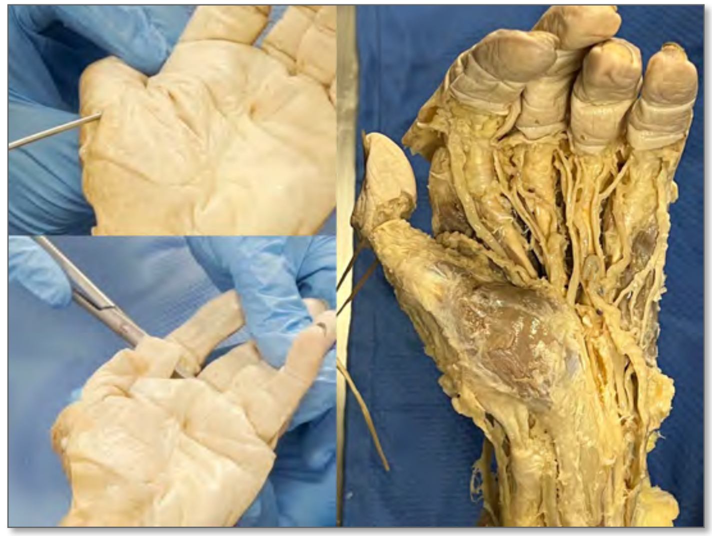

Figure 3. *The same technique is also used in the more challenging palms. The palmar skin is kept intact as on the dorsum, and delicate nerves and vessels are likewise dropped down from the skin with scissor dissection.*

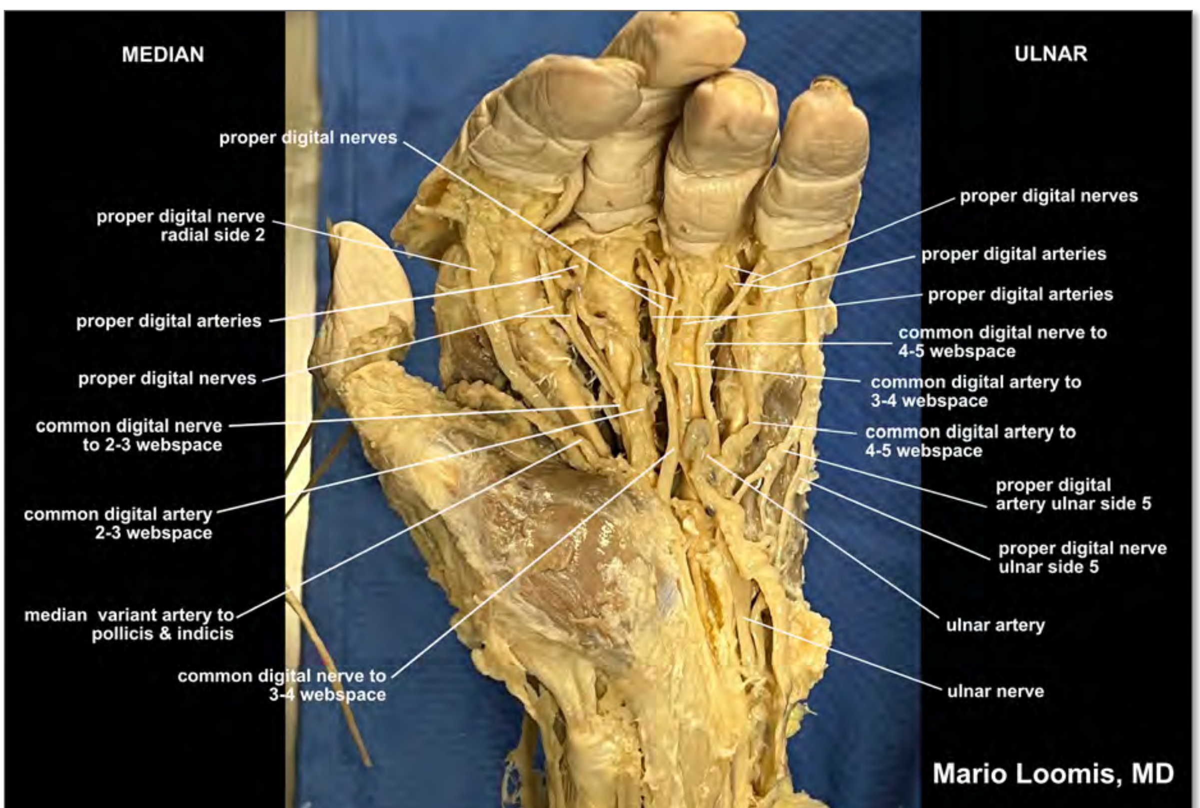

Figure 4. *Tumescence transforms the challenging post-mortem contraction and adherence of tissue planes in the cadaver to more life-like conditions, allowing for a more pleasant and thorough dissection of finer structures.*

continued on next page

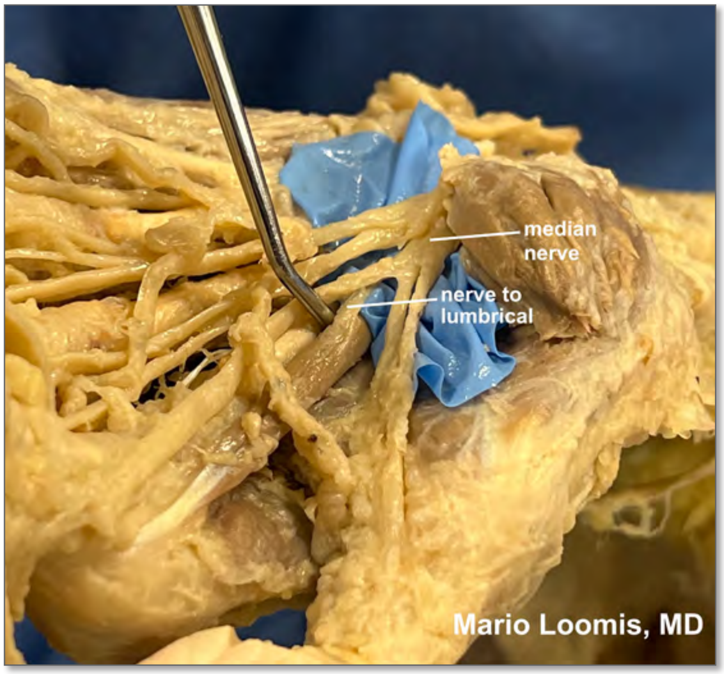

Figure 5. *Very fine structures as the nerve to a lumbrical can be quite easily identified and preserved in the moistened environment.*

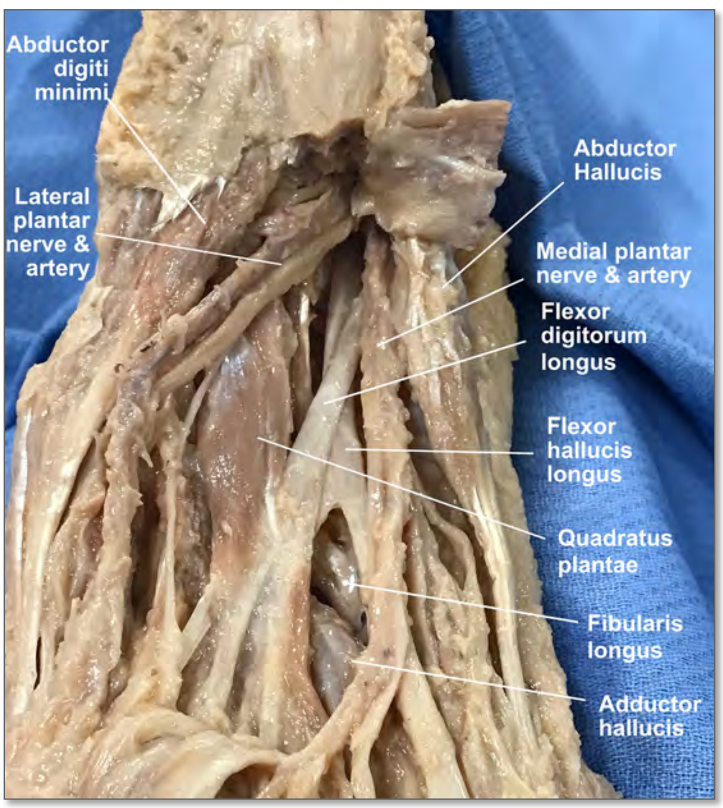

Figure 6. *Tumescence is also used in the particularly challenging area of the sole of the foot where separation of layers and identification of deeper structures is carried out with minimal transection of overlying structures.*

Tumescence was also used in the particularly challenging area of the sole of the foot where separation of layers and identification of deeper structures is carried out with minimal transection of overlying structures (Figure 6).

Discussion

In light of the benefits associated with the use of tumescence, one may wonder why it is seldom used in most anatomy labs. When the senior author began using tumescence in surgery thirty years ago, it was rarely used in that setting as well. As the years passed, and its benefits were recognized, its use became more widespread. Anatomists, much like surgeons, develop and become accustomed to their individual dissection styles and techniques. A new technique, no matter how helpful, brings with it the challenge of change. Tumescence changes the appearance of tissues and makes the field wet and a bit messy.

After successfully dissecting for many years, one may question the need for novelty with its commensurate inconvenience and learning curve. However, if the thought of dissecting an area such as the palm or sole brings on a sense of dread, then the challenge of change may be worth taking. After beginning with palm and sole dissections, the senior author now uses tumescence in all areas of the body wherever a particular donor's tissues are desiccated or adherent. The increase in interstitial space always facilitates the identification and separation of structures along natural tissue planes.

Conclusion

Tumescence in cadaver dissection is a useful technique of hydrating and expanding the interstitial space, allowing for greater ease of dissection, identification of natural tissue planes, and preservation of finer structures.

Acknowledgments

No potential conflict of interest exists between the authors and any products or services referred to herein.

About the Authors

Mario Loomis, MD, is an associate professor and Chair of Anatomy at Sam Houston State University College of Osteopathic Medicine in Conroe, Texas. He teaches clinical anatomy and neuroscience to first-year osteopathic medical students. His interests are in medical education and refinement of surgical dissection techniques. Jonathon Hines, MBA, is a third-year osteopathic medical student at Sam Houston State University College of Osteopathic Medicine in Conroe, Texas. His interests are in human anatomy and how it can best prepare students for clinical rotations and a surgical residency. Amberly Reynolds, PhD, MS, was an assistant professor of anatomy in the Department of Anatomy at Sam Houston State University College of Osteopathic Medicine in Conroe, Texas, at the time of this work. She is currently at Rocky Vista University College of Osteopathic Medicine in Ivins, Utah.

continued on next page

Literature Cited

Allorto NL, Bishop DG, Rodseth RN. 2015. Vasoconstrictor clysis in burn surgery and its impact on outcomes: systematic review and meta-analysis. *Burns* 41(6):1140-6. https://doi.org/10.1016/j.burns.2015.03.010

Duems Noriega O, Arino-Blasco S. 2014. Efficacy of the subcutaneous route compared to intravenous hydration in the elderly hospitalised patient: a randomised controlled study. *Rev Esp Geriatr Gerontol* 49(3):103-7. https://doi.org/10.1016/j.regg.2013.12.003

Hussain NA, Warshaw G. 1996. Utility of clysis for hydration in nursing home residents. *J Am Geriatr Soc* 44(8):969-73. https://doi.org/10.1111/j.1532-5415.1996.tb01870.x

Jones BM, Grover R. 2004. Reducing complications in cervicofacial rhytidectomy by tumescent infiltration: a comparative trial evaluating 678 consecutive face lifts. *Plast Reconstr Surg* 113(1):398-403. https://doi.org/10.1097/01.prs.0000097297.89136.8d

Ng T, Knowles S, Brackstone M, Doherty C. 2019. Mastectomy flap necrosis after nipple-sparing mastectomy and immediate implant-based reconstruction: An evaluation of tumescence and sharp dissection technique on surgical outcomes. *Breast J* 25(6):1079-1083. https://doi.org/10.1111/tbj.13442

Sinha R, Sharma N, Agarwal RK. 2003. Subeschar clysis in deep burns. *Burns* 29(8):854-6. https://doi.org/10.1016/s0305-4179(03)00064-0

Back to TOC