



Jun 12, 2024

Version 1

🌐 Sensor Guided Needle Entry Procedures: A Scoping Review of Advancements to the Veress Needle & selected Needle Entry Techniques Techniques Advancements V.1

DOI

dx.doi.org/10.17504/protocols.io.bp2l621jkgqe/v1

Chimwemwe Miti¹, Richard Scott¹, Hermes Gadelha-Bloomfield¹

¹University of Bristol



Chimwemwe Miti

University of Bristol

Create & collaborate more with a free account

Edit and publish protocols, collaborate in communities, share insights through comments, and track progress with run records.

Create free account

OPEN  ACCESS



DOI: <https://dx.doi.org/10.17504/protocols.io.bp2l621jkgqe/v1>

Protocol Citation: Chimwemwe Miti, Richard Scott, Hermes Gadelha-Bloomfield 2024. Sensor Guided Needle Entry Procedures: A Scoping Review of Advancements to the Veress Needle & selected Needle Entry Techniques
Techniques Advancements.

protocols.io <https://dx.doi.org/10.17504/protocols.io.bp2l621jkgqe/v1>

License: This is an open access protocol distributed under the terms of the **Creative Commons Attribution License**, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited

Protocol status: Working

We use this protocol and it's working

Created: May 11, 2024

Last Modified: June 12, 2024

Protocol Integer ID: 99600

Keywords: Veress needle, sensor, needle entry, primary laparoscopic entry, sensor guided needle entry procedure, veress needle into the abdomen, other relevant needle entry technique, needle entry techniques, technique advancements primary entry, selected needle entry techniques, technique advancements primary entry, other relevant needle entry techniques into critical space, invasive abdominal surgery, veress needle, primary trocar, abdomen, scoping review of advancement

Funders Acknowledgements:

EPSRC funded CDT in Digital Health & Care University of Bristol

Grant ID: UKRI Grant No. EP/S023704/1

Disclaimer

No conflicting interests

Abstract

Primary entry during minimally invasive abdominal surgery remains the one step associated with controversy and complications.

This scoping review attempts to draw literature describing sensor augmented techniques for introducing the primary trocar or Veress needle into the abdomen in a bid to reduce associated challenges. Publications related to other relevant needle entry techniques into critical spaces where sensors are successfully utilised are also briefly reviewed.

It is expected that an overview of related areas in which the technology is applicable and modifications to established techniques alongside the added improvements will be described.

Troubleshooting

Eligibility Criteria

- 1 Studies in English
- 2 Publication period 1992- May 2024
- 3 Articles with full text available
- 4 Human subjects
- 5
- 6

Protocol references

1. Althobaiti M, Ali S, Hariri NG, Hameed K, Alagl Y, Alzahrani N, et al. Recent advances in smart epidural spinal needles. *Sensors*. 2023;23(13):6065.
2. Chitnis GD, Verma MKS, Lamazouade J, Gonzalez-Andrades M, Yang K, Dergham A, et al. A resistance-sensing mechanical injector for the precise delivery of liquids to target tissue. *Nature Biomedical Engineering*. 2019;3(8):621-31.
3. Friebe M, Boese A, Heryan K, Spiller M, Sühn T, Esmaeili N, et al. Surface and Event Characterization-Proximal Audio Sensing to improve Manual and Robotic Device Interventions. *Current Directions in Biomedical Engineering*. 2022;8(1):1-4.
4. Friebe M, Esmaeili N, Spiller M, Sühn T, Boese A, Illanes A, editors. Surgical Audio Guidance: Enhancing Surgery and Surgical Data Exploitation Through Proximal Vibro-acoustic Sensing of Tool-Tissue Interactions. 2023 IEEE EMBS Special Topic Conference on Data Science and Engineering in Healthcare, Medicine and Biology; 2023: IEEE.
5. Friebe M. Toward autonomous robotic-assisted interventions: the value of proximally placed audio-sensors for surface and event characterization. *Authorea Preprints*. 2024.
6. Huang EY-H, Kao M-C, Ting C-K, Huang WJ, Yeh Y-T, Ke H-H, et al. Needle-probe optical coherence tomography for real-time visualization of veress peritoneal needle placement in a porcine model: a new safety concept for pneumoperitoneum establishment in laparoscopic surgery. *Biomedicines*. 2022;10(2):485.
7. Janicki TI. THE NEW SENSOR-EQUIPPED VERESS NEEDLE. *Journal of the American Association of Gynecologic Laparoscopists*. 1994;1(2):154-6.
8. Kang G, Yun J, Cho JS, Yoon J, Lee JH. Micro electrical impedance spectroscopy (μ EIS) fabricated on the curved surface of a fine needle for biotissue discrimination. *Electroanalysis*. 2016;28(4):733-41.
9. Kim J, Yun J, Cho H-H, Lee J-H. Enhancement of detection accuracy in depth-profiling using electrochemical impedance spectroscopy-on-a-needle by incremental compensation for immersion depth. *Journal of Electroanalytical Chemistry*. 2019;838:48-56.
10. Kudashov I, Shchukin S, Al-Harosh M, Shcherbachev A. Smart Bio-Impedance-Based Sensor for Guiding Standard Needle Insertion. *Sensors*. 2022;22(2):665.
11. Masiakos P, Karp JM. A Radial Clutch Needle for Facile and Safe Tissue Compartment Access. 2019.
12. Nevler A, Har-Zahav G, Rosin D, Gutman M. Safer trocar insertion for closed laparoscopic access: ex vivo assessment of an improved Veress needle. *Surgical endoscopy*. 2016;30:779-82.
13. Nillahoote N, Suthakorn J, editors. Development of Veress Needle Insertion Robotic System and its experimental study for force acquisition in soft tissue. 2013 IEEE International Conference on Robotics and Biomimetics, ROBIO 2013; 2013.
14. O'Cearbhaill ED, Laulicht B, Mitchell N, Yu L, Valic M, Masiakos P, et al. A radial clutch needle for facile and safe tissue compartment access. *Medical devices & sensors*. 2019;2(5-6):e10049.
15. Onoda T, Sato M, Torii K, Inamori K, Okada E, Nozawa M, et al. A negative pressure-based visualization technique for abdominal Veress needle insertion. *Langenbeck's Archives of Surgery*. 2022;407(5):2105-13.
16. Postema RR, Cefai D, van Straten B, Miedema R, Hardjo LL, Dankelman J, et al. A novel Veress needle mechanism that reduces overshooting after puncturing the abdominal wall. *Surg Endosc*. 2021;35(10):5857-66.
17. Postema RR, Hardon S, Cefai D, Dankelman J, Jansen FW, Camenzuli C, et al. Pre-clinical evaluation of the new veress needle+ mechanism on thiel-embalmed bodies: a controlled crossover study - Experimental research. *Ann Med Surg (Lond)*. 2023;85(5):1371-8.

18. Riek S, Bachmann K-H, Gaiselmann T, Hoernstein F, Marzusch K. A new insufflation needle with a special optical system for use in laparoscopic procedures. *Obstetrics & Gynecology*. 1994;84(3):476-7.
19. Riek S, Bachmann K-H, Gaiselmann T, Fischer S, Raestrup H, Buess G, et al. Veress needle with optical protective shield and step system: A new safety concept in minimally invasive surgery. *Minimally Invasive Therapy & Allied Technologies*. 1999;8(4):245-54.
20. Sabieleish M, Heryan K, Boese A, Hansen C, Friebe M, Illanes A. Study of needle punctures into soft tissue through audio and force sensing: can audio be a simple alternative for needle guidance? *Int J Comput Assist Radiol Surg*. 2021;16:1683-97.
21. Schaufler A, Sühn T, Esmaeili N, Boese A, Wex C, Croner R, et al. Automatic differentiation between Veress needle events in laparoscopic access using proximally attached audio signal characterization. *Current Directions in Biomedical Engineering*. 2019;5(1):369-71.
22. Schrope J, Olmanson B, Fick C, Motameni C, Viratyosin T, Miller ZD, et al., editors. The SMART Trocar: force, deviation, and impedance sensing trocar for enhanced laparoscopic surgery. *Frontiers in Biomedical Devices*; 2019: American Society of Mechanical Engineers.
23. Serwatka W, Heryan K, Sorysz J, Illanes A, Boese A, Krombach GA, et al., editors. Audio-based tissue classification-preliminary investigation for a needle procedure. *Current Directions in Biomedical Engineering*; 2023: De Gruyter.
24. Spiller M, Esmaeili N, Sühn T, Boese A, Turial S, Friebe M, et al. Towards an intraoperative feedback system for laparoscopic access with the Veress needle: A preliminary interface based on Surgical Audio Guidance. *Current Directions in Biomedical Engineering*. 2021;7(2):29-32.
25. Sun J, Kotaro T, editors. Design of a handheld trocar insertion device for laparoscopic surgery to avoid overshooting. 2018 40th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC); 2018: IEEE.
26. Tabrizi SH, Farzaneh F. A Preliminary Study on the Use of an Automatic Trocar for LAparoscopic Surgery (ATLAS). *Frontiers in Biomedical Technologies*. 2015;2(4):200-5.
27. Teng W-N, Tsou M-Y, Chang W-K, Ting C-K. Eyes on the needle: Identification and confirmation of the epidural space. *Asian journal of anesthesiology*. 2017;55(2):30-4.
28. Wang C, Reynolds JC, Calle P, Ladymon AD, Yan F, Yan Y, et al. Computer-aided Veress needle guidance using endoscopic optical coherence tomography and convolutional neural networks. *Journal of biophotonics*. 2022;15(5):e202100347.
29. Wang C, Liu Y, Calle P, Li X, Liu R, Zhang Q, et al. Enhancing epidural needle guidance using a polarization-sensitive optical coherence tomography probe with convolutional neural networks. *Journal of Biophotonics*. 2024;17(2):e202300330.
30. Yun J, Kim HW, Kim H-I, Lee J-H. Electrical impedance spectroscopy on a needle for safer Veress needle insertion during laparoscopic surgery. *Sensors and Actuators B: Chemical*. 2017;250:453-60.