

Fig. 4: Ultrasound examination in the OR to rule out hepatic metastasis intraoperatively during colorectal cancer surgery.



Fig. 5: Outpatient ultrasound scan following iatrogenic injury of the popliteal artery. The injury was managed via preperitoneal patch repair and visualization of the popliteal region using triphasic pulsed wave (PW) Doppler spectra.

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The new Viamo ultrasound system in the OR: versatile, rapid, simple and good

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ULTRASOUND CT MRI X-RAY SERVICES

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Introduction

In the OR, the ICU, the emergency room and in many other setting, surgeons need fast diagnostic imaging tools to assess acute conditions or changes in the patient's clinical status. The modality of choice in such settings is ultrasound as it allows for a rapid diagnosis, does not expose the patient to ionizing radiation and is widely available.

The advent of portable ultrasound devices has made it possible to perform ultrasound scans expeditiously right at the patient's bedside. In order to make the advantages of portable systems available also to less experienced operators like surgeons in the OR or in the ICU, who use ultrasound less frequently in their daily work, the system needs to be easy to operate, offering excellent image quality straightaway without the need for fine-tuning and optimizing by an expert.

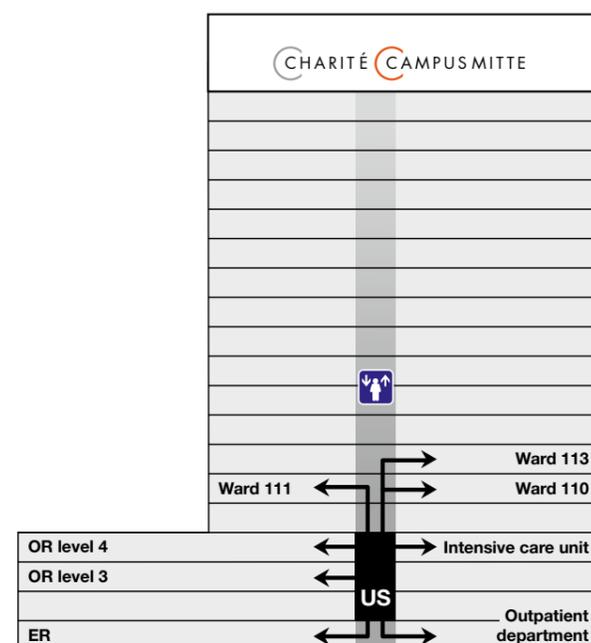


Fig. 1: Complex route in the Charité's patient wing, via an elevator (gray) and staircases and corridors (black).

Pilot project at Charité

A decentralized approach requires availability of a portable ultrasound system with centralized image transfer in the hospital at all times. Such a system must combine ease of use with excellent image quality and processing performance to satisfy the needs of the internists who perform the initial examination as well as the specialists who do the follow-up investigations. Toshiba's new portable Viamo ultrasound system appears to meet all of these criteria and was therefore given the opportunity to prove its suitability for a decentralized imaging approach. The pilot project was carried out under the aegis of the ultrasound research lab at the radiology department of Charité, Berlin, Germany, (www.uslab-charite.de) in collaboration with the hospital's surgery department. The trial of the Viamo focused on its suitability for everyday use. The different requirements of the relevant surgical disciplines, the relatively low level of ultrasound experience and technical training on the part of the ten surgeons involved in the trial, posed a major challenge.

Broad range of applications

The scope of care provided by the surgical department of a full-service hospital such as the Charité was reflected by the organs that were examined sonographically during the trial: abdomen: 29%; thorax: 27%; central and peripheral vessels: 18%; soft tissues: 20%; kidney, bladder and heart: 7%. These investigations were carried out intraoperatively, in the intensive care unit, on regular wards, and in the outpatient surgery department. 90% of the examinations were successfully performed using five of the 12 standard settings (abdomen: 12%; thorax: 25%; surface soft tissue: 18%; peripheral arteries: 18%; veins: 5%) – a clear indication of Viamo's ease of use and outstanding performance. The standard settings were devised in collaboration with the radiologist with a view to enabling surgeons to use the device quickly and easily. The ten surgeons who conducted the trial were given two hours of system training and received a user manual. All of the surgeons had at least five years of work experience as well as basic ultrasound screening skills.

Performance rating

The average examination time was 10 minutes (range: 2–30 minutes). Only 20 percent of the examination time – that is 2 minutes (range: 1–5 minutes) were taken up by defining the settings and starting the device. The surgeons assessed the device's performance using a visual analogue scale ranging from 1 (excellent) to 6 (poor). The mean point score for "device operation as a whole" and "menu navigation" was

Decentralized use of ultrasound

As indicated by Fischer et al. (Ultraschall in Med, 2002) the availability of portable mobile ultrasound systems in a hospital radiology department can expand the diagnostic imaging process as a whole within the hospital and help to reduce overall examination time by cutting patient transportation time. Long transport routes (e.g., in a surgery dept. that uses ultrasound, see Fig. 1) significantly prolong overall examination time. Inasmuch as the doctors carry the devices themselves, decentralized availability of a portable ultrasound system for both acute diagnoses and basic screening would appear to be a suitable paradigm for a hospital's basic ultrasound needs. For more complex diagnoses, a doctor with more ultrasound experience can be called in or scans with other modalities can be carried out in the radiology department. In order for such a decentralized basic ultrasound approach to work, it is essential that the ultrasound staff in the radiology department cooperate closely with the other hospitals or departments involved. Each discipline can carry out standard ultrasound exams on their own, and if necessary can request specific follow-up scans, require more complex diagnostics, and leverage the RIS/PACS of the relevant radiology department. Structured supervision is ensured by a certified radiologist monitoring and approving the findings and the doctors involved will benefit from continuously developing their ultrasound scanning skills through daily practice.

| Performance Criteria | Mean Score |
|------------------------------------|------------|
| Device Operation | 1.2 |
| Menu Navigation | 1.2 |
| Display of Results | 1.4 |
| Operator Satisfaction with Results | 1.2 |
| Overall | 1.3 |

Fig. 2: Performance scoring of Viamo

1.2, and all rankings were either "excellent" (78%) or "good" (28%). Display of the results was ranked as very good for 82% of the examinations, good for 10% and fair for only 8%, although in the latter cases complex screening scenarios were mentioned in particular. Overall satisfaction with the results averaged 1.2, and the Viamo as a whole garnered a 1.3 ranking on average (see Fig 2).

Cost considerations

In order to assess the financial implications of the purchase of a dedicated ultrasound system for our department under the current reimbursement system we prepared a rough cost calculation: Our surgical department sees an average of 350 inpatients per month, and performs a monthly average of 115 ultrasound screenings on these patients.

Based on a current reimbursement rate of app. 8 €/ exam our department would receive app. 900 €/ month for these exams. Ultrasound-related personnel costs amount to app. 600 €/ month, based on a gross hourly salary of 30 € for the doctor, 115 examinations/month and a mean examination time of ten minutes. Consumables and maintenance would cost the department another 25 € month. This would amount to a net revenue for the department of 275 €/month from the usage of the ultrasound system. Obviously, this amount does not cover depreciation costs and ancillary costs for example for user trainings and quality assurance.

To justify the acquisition of such a system for the department other benefits – workflow improvements of the overall processes in the department, faster decision making, reduced examination times, shorter waiting time for the patients, increased diagnostic accuracy, etc. – have to be taken into account. Moreover, in our case, during our three months' use of the Viamo ultrasound system interdisciplinary collaboration improved since more cases were investigated in an interdisciplinary manner and this collaboration translates into more reliable and accurate diagnoses.

Conclusion

All ten surgeons who tested the device underlined the following positive aspects: the device's versatility; short startup time; ease of operation; the fact that the image can be optimized without the use of complex settings procedures and the outstanding results delivered by the device's exceedingly good image quality.



Fig. 3a: Ultrasound examination in the intensive care unit immediately following femoral artery surgery.

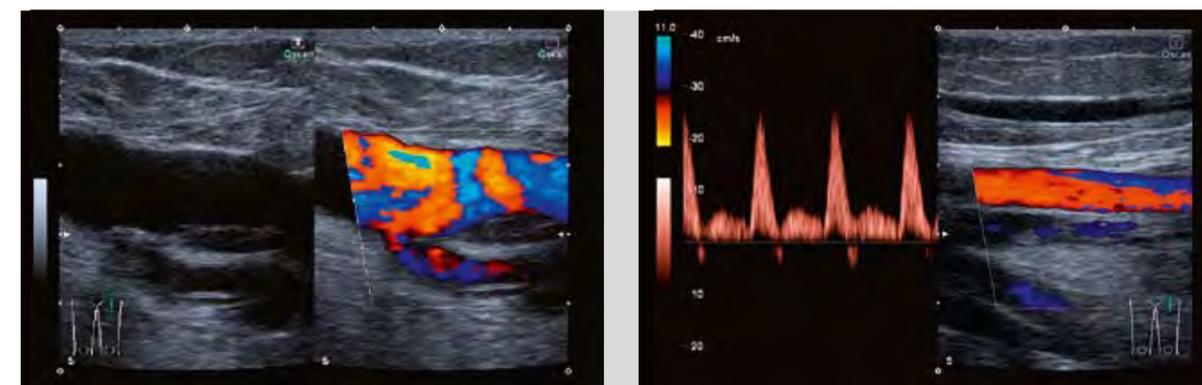


Fig. 3b: Small wall hematoma and low turbulence after the outlet of the lower femoral artery. Pronounced triphase spectra below this point.