

# How to choose an ultrasound machine for your Emergency Department

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## Key steps

1. Decide on your needs
2. Decide on your budget
3. Pick the best machines for your budget
4. Head-to-head comparison
5. Try out a loan machine
6. Negotiate the best price

## Step 1: Decide on your needs

Traditionally EDs have had only one or two machines, with a minority of doctors using the machine for only a few indications. Under that model of care, it made sense to simply buy the easiest and simplest machine available.

Now that model is changing:

- More of us are using US in our daily practice: therefore more machines are needed in each department.
- The questions we ask are becoming more complex: therefore higher-end machines (e.g. with Doppler capability) are needed
- Quality assurance: there is more of a push to archive images for later review or for review by other teams: therefore machines with ability to send images to Radiology archives (PACS) may be useful

Possible solutions include:

- Buy two or three mid-range machines
- Buy one high-end machine for complex cases as well as several cheaper machines (that can be used for screening in trauma / shock, line insertion etc)

## Step 2: Decide on your budget

- Put together a business case for new machine(s). Quote the benefits to patient care (increased accuracy and timeliness of diagnosis) and to department flow. Quote studies that demonstrate effectiveness of US. Some examples include:
  - <http://www.nice.org.uk/guidance/ta49> UK NICE guidelines on US guided CVC access
  - <http://www.ncbi.nlm.nih.gov/pubmed/16934640> Melniker LA et al (the SOAP trial of trauma ultrasound)
  - <http://www.ncbi.nlm.nih.gov/pubmed/22392031> International consensus guidelines on lung ultrasound
  - <http://www.ncbi.nlm.nih.gov/pubmed/10088853> Scalea et al, *International consensus guidelines on lung ultrasound*

- If your ED has no money, approach charitable organisations for funding

### **Step 3: Pick the best machines for your budget**

Consider the following:

#### Cost

Paradoxically this is less important than it seems. Competition between point of care US vendors means that many are willing to drive down their price to match their competitors.

#### Type of machine

- Behemoth: the machines used by radiology departments are massive, horrendously expensive and barely mobile but can be bought cheaply from your radiology colleagues when they upgrade, and can be stored in a room for those extra special cases
- Cart based: the traditional ED solution, also the most expensive point of care machine but with the best quality images for our budget and hard to steal because mounted on a cart
- Wall mounted: flat screen, cheaper than cart based with simpler controls, fewer options and lower quality images
- Pocket sized: the cheapest, with lowest quality images and easily stolen by unscrupulous colleagues. Still an emerging market. (Conflict of interest: JB is on the medical advisor board of Signostics, which makes one such machine)
- Find out what machines are being used by your colleagues: not just in ED but also elsewhere in your own hospital (ICU, anaesthetics, cardiology, radiology). It makes sense if everyone is using similar machines, and can increase your negotiating power (see step 5)

#### Warranty / service

- Type and length of warranty is one of the most important aspects of buying a machine. Ask the sales rep **in detail** about the warranty / service their company offers. The best warranty is one that is backed by the manufacturer, allows replacement of at least one probe / year as well as the battery.
- The best service plan is one with 24/7 access and rapid turnaround: you don't want your machine 'dead' for a week while the company tries to replace it. Ask for a contract which includes delivery of an exchange machine within 24 hours.
- There should also be 24/7 troubleshooting access to a sonographer familiar with the machine, to answer those weird questions you have later (e.g. how to optimize Doppler in that tricky patient). If the vendor doesn't employ a dedicated sonographer, don't deal with them.
- Breakable parts (probes and cables) should be easy exchangeable

#### Durability/ Maintenance/

- Get the toughest machine you can, one that can handle multiple users and prolonged use

- All parts should be easy to clean: screen, probes and cables, probe holders, keyboard (ideally touch key)

#### Storage:

- Decide where you will store the machine
- Needs to be central and near the resuscitation area
- Needs power outlets

#### Size:

If buying a cart based system:

- Compact cart size with width and depth kept to a minimum
- Additional drawers / space to store gel, sterile covers
- High quality wheels, that lock/unlock easily and move in all directions

#### Ease of use:

- Quick boot-up time, or sleep mode
- Long battery life
- Keyboard not overloaded with function keys (some touch screen machines have the option of 'putting to sleep' many of the higher-end controls)
- Main keys highlighted or separated
- Easy to understand for novices / occasional users
- Bar code reader: some machines have this facility, which allows the operator to simply scan the patient ID wrist band, for ease of data entry.

#### Image quality:

- Good image quality for many applications
- High 2D image quality
- Should have tissue harmonic imaging on/off, M mode, colour flow and pulse wave Doppler
- Large, high quality monitor which allows different viewing angles
- (ideally adjustable in height and distance to user)

#### Probes (transducers):

- Robust
- Ideally 3 probes: cardiac (aka sector or phased array), linear high frequency (for vascular access, superficial exams), curved (for abdomen)
- Multiple ports to allow switching between probes without changing ports
- Device such as a probe arm to lift cables off the floor

#### Image saving and archiving

- Picture saving, reviewing and exporting should be simple
- Large hard drive
- Should have facility to save PC-compatible images (e.g. still images as JPEG, cineloops as AVI or MP4)
- Should also have facility to save DICOM-compatible images, in case your ED decides to archive its images with radiology PACS. DICOM is the image format used by radiology department ultrasound machines.
- Ideally facility for wireless transmission when archiving
- External HDD storage solutions / options (most machines have USB storage option)

#### **Step 4: Head-to-head comparison**

Traditionally vendors prefer to show their machines separately, but it makes more sense to compare them on the same subjects at the same time. Some vendors hate this, others welcome the opportunity.

If you decide to run a head-to-head comparison, there are some ground rules to follow:

- Keep it small: just 2 or maximum 3 machines
- Inform everyone beforehand- don't spring it as a surprise on the vendors
- Include a representative range of staff- not just the experienced users but also average users and novices
- Consider including other stakeholders e.g. clinicians from other services who might want to use your machine in the ED. For example, obstetric doctors and cardiologists who might scan patients in the ED
- Allow plenty of time (at least 2 hours), including for individual demonstrations of each machine: vendors rightly complain when they don't have enough time to demonstrate all the features that make their machine special
- Run the session in the environment you intend to use it: i.e. in your ED, on real patients. Ideally select patients that are as difficult as possible to scan, not just the skinny ones.
- Try out as many applications as you can. At a minimum, scan aortas and hearts (ideally in obese patients), central veins and peripheral nerves.
- Remember consent & privacy: ensure that all the images collected that day are wiped from all the machines at the end of the session

#### **Step 5: Try out a loan machine**

If they're serious, vendors will be happy to loan your department a machine for a week or so. Make sure as many people as possible try out the machine and get their feedback.

## **Step 6: Negotiate the best price**

This last step isn't about ultrasound, and it's best done by the most hardnosed person in your department. Remember you are up against business people who do this for a living.

- Start with a lower price than you intend to pay
- Don't worry about hurting anyone's feelings
- Consider buying in bulk: team up with other EDs or departments to achieve a discount
- Don't be afraid to wait: there's always another vendor about to bring a new machine onto the market

Good luck!