Blood tubes should be appropriately labelled and checked by the patient before departure

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Blood collection is almost an inevitable event in clinical medicine these days. The question of blood tube labelling is sometimes vexatious—not whether the tubes should be labelled, as this is without question—but rather whether tubes should be labelled before or after blood collection, or whether indeed either practice is considered acceptable. This particular viewpoint article is meant to be a moderator piece, and to try to balance the sometimes strongly-opposing views, as expressed in this journal by two robust and juxtaposed articles (1,2).

In the first viewpoint perspective (1), Lippi and Plebani take the strong view that blood tubes should be labelled before blood collection, and that these tubes should then enable collection of a particular patient's blood. One of their main arguments hinges on the use of automated tube labelling systems (e.g., the system ProTube, as produced by Inpeco SA, Lugano, Switzerland; http://www.inpeco.com/en/our-solutions/around-the-lab), as reducing potential human-driven errors (3), and that such systems cannot label tubes after blood collection. Lippi and Plebani are also of the viewpoint that most of the arguments put forward by proponents in favor of labelling tubes after collection, or against labelling tubes before collection, do not actually hold true *only* for individual labelling time-points. The authors express many other arguments in favor of labelling before collection, including citing one study that identified that the vast majority of phlebotomists (up to 78%) tended to label test-tubes only after having left the patient (4), with the inherent risk that interruption or time pressures might cause later labelling errors.

Contrasting these views is the perspective expressed by Ernst, Fritsma and McGlasson (2), who take a similarly strong viewpoint, but in this case that blood tubes should be labelled only after blood collection. Among the arguments expressed in this viewpoint is the potential for pre-labelled tubes to go unfilled (due to a difficult draw, patient illness, syncope, patient refusal, etc.), thus leaving collectors with pre-labeled tubes that, if not discarded, could be mistakenly used on another patient. The authors also cite a myriad of guidelines, especially that produced by the Clinical and Laboratory Standards Institute (CLSI) (5), which recommend tube labelling after blood collection.

It is interesting that both viewpoints express such differing views so strongly, and yet also cite similar references in support of the differing views. Both viewpoints cite references to show that mislabelling of patient tubes has the potential to cause serious patient harm. Lippi and Plebani, for example, cite a College of American Pathologists (CAP) study that identified that the aggregate frequency of identification error can be as high as 379 per 1 million billable tests, half of which are caused by primary specimen labeling errors and approximately 6% of which may generate adverse events (6). Both groups of authors (Lippi and Plebani; Ernst and colleagues) cite another study which reviewed 4.29 million specimens collected over 24 months and found the frequency of mislabelled specimens, unlabelled specimens, and specimen-requisition mismatches to be 1.0%, 4.6%, and 6.3%, respectively, with undetectable mislabelling presenting the greatest danger (7). Both viewpoints also cite several guidelines (5,8-10), with Lippi and Plebani suggesting that some guidelines are unclear about whether labelling should occur before or after, and/or acknowledge that either practice may be suitable, provided that the labelled tubes are checked and

Table 1 Arguments for pre- and post-labelling of blood collection tubes

Arguments for pre-labelling
Enables use of automatic tube labelling devices which save time and reduce errors due to manual (mis)labelling
Automated labelling permits additional information to be added to tubes
Will reduce the frequency of wrong-blood-in-tube errors, positively impacting patient care
Many guidelines are ambiguous about whether labelling should occur before or after blood collection
Arguments for post-labelling
Will reduce the frequency of wrong-blood-in-tube errors, positively impacting patient care
Most guidelines recommend post collection labelling
Comments
The same arguments are often used for/against each option, whereas the evidence base to specifically support either single viewpoint is essentially non-existent
In respect to time of blood tube labelling (before vs. other), guidelines are generally expert-opinion, not evidence based

confirmed by the patient. Ernst and colleagues instead hold the view that the majority of guidelines suggest that labelling after blood collection is preferred.

So, which viewpoint is 'correct'? Is one viewpoint right, and the other viewpoint wrong? Or are they both 'correct'?

What is actually missing from both viewpoints (1,2), and indeed this viewpoint, is any solid substantiation that one practice is actually more evidence-driven than the other. The evidence simply does not exist that labelling tubes before collection is safer than labelling tubes after collection, or vice versa that labelling tubes after collection is safer than labelling tubes before collection. What each viewpoint expresses is simply an expert opinion, as reflected by the relative experience of each authorship group.

As this is also a viewpoint article, I will convey my own 'expert-opinion' and personal recommendations for blood collection:

- Unless they are unable to, patients should state their full name and birth date, and confirm the spelling of their names;
- Unless they are unable to, patients should show a form of identification if an ID band is not in use (e.g., a driver's license and/or insurance card for outpatients);
- Specimen tubes should be labelled using at least two patient identifiers (e.g., full name and medical record number or date of birth);
- Additional information on tubes should include date and time of collection;
- Unless they are unable to, the labelled tubes should be checked and confirmed as being correct by the same patient;
- The blood collector should also be identified, preferably in an electronic database as well as on the collection tubes.

I have no strong personal opinion as to whether tubes should be labelled preferentially before or after collection. *Tables 1* and 2 provide a summary of arguments for and against pre/post collection labelling, as well as some mitigating comments. To my mind, it makes sense to have tubes pre-labelled for collection, should an automated labelling system be available, as this will reduce manual transcription errors. Should such a system not be available, then labelling could indeed be undertaken after blood collection. Indeed, no reasonable worker in the field would advocate blanket pre-labelling of blood collection tubes on mass, for example using printed labels at a remote site, and then taking these collections of tubes to areas of blood collection and then trying to match these tubes with patients. Such an approach would likely be chaotic and fraught with danger. Pre-labelling of tubes is best undertaken on a patient by patient basis, in the presence of the patient, after positive patient identification has been achieved. Automated tube labelling systems can facilitate accurate patient identification and collection (3).

In either case, pre-labelling or post-labelling, the labelled tubes should then be checked and confirmed as belonging to the patient (unless of course this is not feasible; e.g., unconscious patient). If any prelabelled tubes are not used for an intended blood collection, then they should

Table 2 Arguments against pre- and post-labelling of blood collection tubes

Arguments against pre-labelling
Increased risk of collecting unsuitable samples
Will increase the frequency of wrong-blood-in-tube errors, negatively impacting patient care
There is no evidence pre-collection labelling reduces labelling errors
Pre-labelling can impede visual confirmation that the tube is filling and obscure the manufacturer's optimum fill indicator, leading to under-filled tubes and higher sample rejection rates
Arguments against post-labelling
Increased risk of collecting unsuitable samples
Will increase the frequency of wrong-blood-in-tube errors, negatively impacting patient care
There is no evidence post-collection labelling reduces labelling errors
Delayed labelling of tubes and potential to apply incorrect labelling on tubes
Potential to mislabel blood tubes from multiple patients collected in the same area
Preclusion of using automatic tube labelling devices
Comments
The same arguments are often used for/against each option, whereas the evidence base to specifically support either single viewpoint is essentially non-existent
If pre-labelled tubes are employed but not used, they should be discarded. If local economics do not permit discarding these unused tubes, then pre-labelling should not be used

be discarded. If local economics prevent this 'wastage', then pre-labelling should not be instigated at that facility. Indeed, in the end, facilities should select a procedure that works locally, document the procedure (as a 'standard operating procedure'; SOP), and ensure that the procedure is followed—this may require education and continual monitoring of personnel, for example by competency assessments.

It seems that there is a geographical divide on the question of pre-/post-collection tube labelling. Within Europe, the presiding viewpoint is to prelabel blood tubes, and then collect the blood samples, as expressed in 'local' European guidelines (8). Indeed, this requirement appears to be even mandated by some national authorities (e.g., Sweden, Germany). Instead, within North America, where CLSI guidelines (5) 'preside', the dominant viewpoint is to post-label blood tubes. As indicated in the viewpoint by Ernst *et al.* (2), an online survey hosted by Fritsma Factor (https://fritsmafactor.com/), as managed by one of the authors to the 'post-collection labelling viewpoint' (2), showed a distribution skewed towards labelling post-collection (at last count, of 124 votes, 66% favored post-collection labelling, and only 34% favored pre-collection labelling). However, this again reflects opinion, and is not evidence based. The geographical distribution of the votes is not available, but it is suspected that the majority of those favoring post-collection labelling originate from North America, or at least mirror participants following CLSI guidelines (5), whereas the majority of those favoring pre-collection labelling most likely originate from Europe, or at least mirror those following European guidelines (8).

Ultimately, there is a need for proper evidence to identify whether one or other procedure actually reflects better patient care. Ideally, this would require well-designed 'double blind randomized trials', not only to clarify relative patient safety risks associated with pre- *vs.* post-labelling of blood tubes, but also to consider future technological advancements that may improve preanalytical processes, maximize workflows and minimize the possibility of human error. But of course, double blind is likely an unattainable target, given the comparators would be pre- *vs.* post-labelling, and this event would be difficult to blind!

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Footnote

Conflicts of Interest: The author has no conflicts of interest to declare.

Disclaimer: The views expressed herein are those of the author and not necessarily those of NSW Health Pathology. Naturally, other workers in the field may have differing perspectives based on their own experience.

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