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## Discussion

### Presenter: Dr Serban C. Stoica



**Dr Pedro J. del Nido** (*Boston, Mass.*). Thank you, Dr Stoica, for a very nice presentation. This is a very challenging study, as I'm sure you found out, primarily because the definition of an unplanned (if you will) reintervention can vary from center to center. We found this when we were studying the technical performance score, that you had to preemptively agree on a definition. Otherwise, you really could not collect data

appropriately. Certain unplanned re-interventions such as pacemaker for complete heart block are much easier to adjudicate, but other types of defects, such as atrioventricular (AV) valve regurgitation, will vary tremendously from center to center.

Did certain types of unplanned reinvention tend to cluster, at least with certain types of lesions? For example, aortic arch interventions tend to be more little bit more common in postoperative Norwood patients or in interrupted aortic arch. Revisions of shunts were relatively more common in Norwoods than in AV valve regurgitation procedures. For other lesions such as any AV canal or AV septal defect, these relationships are obvious. The tetralogy relationship was a little less obvious to me. I think I'd like to ask you for a little bit more clarity about what types of re-interventions we are talking about. Were they mostly catheter versus surgical, and do they have to do primarily with the branch pulmonary arteries as opposed to the ventricular septal defect?



**Dr Serban C. Stoica** (*Bristol, United Kingdom*). Thank you for your questions. I will re-share some of my slides. I don't know the answers for these associations off the top of my head. You've seen the variability of combinations, so I'll try and find it here and answer your question. I'm not seeing

anything standing out on the catheter unplanned reintervention, so I am thinking that many of the tetralogy cases are in this graph of surgical reintervention. You see the blue dot here with the tetralogy of Fallot; also double outlet right ventricle repair, they are put in the same bin to simplify a little bit. And many of these have residual ventricular septal defect closures. Some have tricuspid valve intervention, there is 1 that had right ventricular outflow tract obstruction relief—a combination of procedures.

For the print publication, the graph will be simplified. I'd also like to point out that the thickness of these lines is proportional to the number of patients we see—and there are only about 4 or 5 at most in the thickest lines.

**Dr del Nido.** That also gets to the question about the detection of the residual defect, as well as the timing of it. Do all of these institutions have, as a routine practice, a transesophageal echocardiogram intraoperatively both pre and post, particularly after end-of-procedure evaluation?

**Dr. Stoica.** Yes, thank you for this question, and I can see that this ties in nicely with the recent concept that your institution is promoting of the residual lesions score and the Pediatric Heart Network study that is starting in North America. So yes, in the United Kingdom, we have intraoperative echocardiogram standard of care for open heart surgery and other procedures as required.

And we try to have a good technical result at the end. You have shown in your research that what matters most when

you leave the operating room is to have a good technical result. Sometimes this means going back on bypass to fix residual lesions. So that doesn't belong to the definition, if you will, because we accept that we have to do our best in theatre and then the clock starts when you go to intensive care. In summary, yes, we do transesophageal echocardiogram and we try to act on results there and then.

**Dr del Nido.** Do you have a sense of the timing of when the reintervention was done and the influence that it had on length of hospital stay and particularly mortality, because your mortality numbers were very impressive? The message here is if you have an unplanned reintervention, pretty much regardless of any sort, your mortality is substantially higher. Is timing of the reintervention important, and do you have that data?

**Dr Stoica.** Yes. We know that on average the reintervention takes place after about 8 to 9 days; that is the median time to reintervention. We are missing about 20 data points for reintervention due to some data cleaning issues, and I have a disclaimer slide because we're a little bit overtaken by clinical work during the viral epidemic.

In the manuscript we are going to present clean data, but because of low numbers overall for various associations, I don't think we can draw very strong conclusions. The slide with the effect of mortality is indeed showing a clear independent effect of unplanned intervention.

There was a recent article by Drs John Costello and Marshall Jacobs based on the Society of Thoracic Surgeons Database with the experience of unplanned reintervention in North America and that is based on administrative data. If I am not mistaken, they showed that the odds ratio for death when you have this complication is about 5.5. We also found a 3-fold increase in death, which after matching can be attributed to this complication alone—within the other limitations of the study, even if it is a prospective study.

**Dr del Nido.** I would argue that timing is probably the critical factor. Residual defects are going to occur; I mean, we're all human and a residual ventricular septal

defect or residual arch obstruction or something of that nature, it's going to happen. The question is, how long do you let the patient deal with that unphysiological state before you intervene? I think that intuitively, we all would agree that the earlier you intervene, the better. So, the focus really needs to be on early detection and early reintervention rather than simply accounting for it as a risk factor.

**Dr Stoica.** I completely agree with you. I think all our instincts are saying that if a problem is detected, it is best fixed early. But sometimes I think these reinterventions come from the fact that perhaps the preoperative decision making was not optimal. In the article that I mentioned earlier, Dr Costello and colleagues make the point very well that the index procedures that have an associated rate of the intervention of 5% and above deserve a lot of careful preoperative planning and the decision-making process is key. So perhaps we didn't do the right operation in the first place—perhaps we started with thoracotomy when we should have done a sternotomy for a hypoplastic arch, for example.

**Dr del Nido.** Thank you. My final question relates to how we deal with novel procedures. The definition of a novel procedure is something that hasn't been done very frequently. So, there will be problems with that; that's the nature of developing something new. How do you take that into account in this methodology, and did you exclude any procedures that were deemed at least to be innovative?

**Dr Stoica.** No, we have not excluded anything other than transplantation; a number of rare operations are included in unclassified procedures. You are of course right in saying that this level of transparency can perhaps stifle innovation. In our profession, we should be careful that if we don't innovate ourselves, we should be open to adopting new procedures so we are not constrained by the straitjacket of diagnostic and procedure classifications. We have to be accountable, but at the same time we have to innovate and adopt innovation.

**Dr del Nido.** Very nice presentation; thank you.