

Pacemaker dependency after permanent pacemaker implantation following cardiac surgery and transcatheter aortic valve implantation

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Impact

We aimed to investigate the issue of permanent pacemaker implantation and pacemaker dependency after permanent pacemaker implantation following cardiac surgery and TAVI. The underlined problem of pacemaker dependency in follow-up has been studied, showing higher mortality of pacemaker dependent patients compared to patients with recovery of atrio-ventricular conduction (**chapter 2**). Also, as emphasized by the current literature (**chapter 3**), sometimes, up to 50% of the patients may recover from rhythm, already 1 month post-operatively in TAVI patients. Additionally, in the majority of patients undergoing cardiac surgery procedures, recovery of rhythm also occurs in the first month post-operative.

Once we studied the pacemaker dependency, we investigated the rate of PPI after cardiac surgery and TAVI. Atrioventricular conduction disturbances leading to PPI may be influenced by predictive factors as male sex (**chapter 4**), type of valves (**chapter 7**), presence of pre-operative conduction disturbances (**chapter 8 and 9**), age of the patients (**chapter 4**)... (**chapter 4 to 9**). Currently, rate of PPI after TAVI is stable in the Netherlands (**chapter 4**), while PPI after SAVR is significantly growing (**chapter 5**). This temporal trends highlights also the need for patient-tailored pre-operative inform consent, as predictive factors may influence the rate of this complication.

Additionally, we focused our research on new devices by a comparison of the sutureless Perceval valve (**chapter 9**) with conventional stented valves in the surgical aortic valve replacement and another analyses of different devices types (**chapter 7**). Also, the combination of female sex with specific devices in TAVI patients has been studied (**chapter 6**).

Clinical Impact

As recovery of atrio-ventricular conduction occurs preferentially in the 6 first month post-operatively (**Figure 2, Panel A, chapter 2**), it may emphasize a possible mishandling of PPI during the hospitalization stay, as the current guidelines do not provide clear recommendation on timing for post-operative PPI. Nowadays, as no uniform agreement is reached across clinicians, the indication and timing for PPI is always left to the discretion of the cardio-surgical and/or electrophysiologist teams. The length of stay may be substantially reconsidered, once the optimal management of such complications will be known. Additionally, as PPI have been associated with pacemaker-related complications (infection, lead dislodgments, pneumothorax...), avoiding such disagreement by characterizing patients who will not be long-term pacemaker dependent should lead to a better management of such patients.

Scientific Impact

There is currently an explosion of new devices and techniques, as valve used for TAVI or sutureless valves as PERCEVAL. As these new technologies bring us to the minimally invasive way to treat our patients, it appears crucial to manage the potentials related-complications, as PPI. Indeed, some devices (mechanically expandable) (**chapter 7**) or some characteristics of the device (valve size XL in the Perceval Valve) (**chapter 9**) may lead to potential increase of post-operative PPI. These results should also help to improve the design of such existing materials in order to better protect the atrio-ventricular conduction system during these interventions. Indeed, some devices (**chapter 6**) may lead to an increase PPI rate in certain patient. Further investigations are

needed to understand the mechanisms of atrio-ventricular conduction disturbances in specific patients.

Societal Impact

The issue of PPI involves all patients submitted to cardio-surgical procedures, also TAVI. From 2013 to 2018, 1122 patients received a PPI after TAVI (n=900, **chapter 4**) or isolated surgical aortic valve replacement (n=222, **chapter 5**) among 16 Dutch centers in The Netherlands. These patients represent thus a subgroup with increase care consumption due to the related-follow-up procedures (pacemaker test, additional cardiology visits...). A better understanding of the underlined mechanisms leading to post-operative PPI and a better pre-operative patient's selection may help to improve outcomes in these categories of patients.

Additionally, conduction disturbances may appear crucial in the current area of expansion of minimally-invasive procedures, such as TAVI and sutureless valve use to young patients. Indeed, as conduction disturbances requiring PPI after TAVI and sutureless still limits the indications of TAVI and use of sutureless valves, improvements and precisions in the management of such a complications may contribute to extent these techniques to younger patients, making them benefit from the others advantages of minimally invasive procedures (length of stay, quality of life, wound complications...).