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Original research article

Cost effectiveness analysis of out-patient and remote monitoring of patients after pacemaker replacement from the perspective of the health care payer

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ABSTRACT

Objectives: To determine the cost effectiveness of remote vs. outpatient monitoring of patients with pacemaker after device replacement due to battery depletion.

Background: Despite the fact that modern pacemakers can be checked remotely, most check-ups are still carried out during outpatient visits. So far, a cost effectiveness analysis of remote monitoring has not been performed in the Czech Republic.

Patients, methods: A retrospective analysis was done using the files of 217 patients that had undergone pacemaker replacement between 2002 and 2005. All visits from 2002 to 2015 were analyzed. Using a pharmacoeconomic model, a cost minimization analysis was made to compare the costs of outpatient visits relative to remote monitoring of pacemakers, from the perspective of the health care payer.

Results: The costs for the out-patient follow-up of the analyzed group of patients were calculated to be 802,709 CZK. Remote management for the same group would have cost 6,398,631 CZK. Cost minimization analysis showed that remote monitoring would have cost 5,595,922 CZK more than current standard care.

Conclusion: Remote monitoring, is from the perspective of the health care payer, not associated with costs reduction in patients after pacemaker replacement due to battery depletion compared to standard out-patient follow-up.

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Introduction

Cardiac pacing is standard method for treatment of severe bradyarrhythmias. The Czech Republic, with 900 implants of pacemakers/million citizens annually, is on par with other European countries [1]. After pacemaker implantation, patients should be followed regularly in a specialized facility, with the goal of ensuring optimal performance of the device and to detect possible malfunctions as soon as possible. Modern pacemakers are equipped with remote interrogation tools. The tools can monitor the same pacemaker functions as those monitored during office visits, although, reprogramming is not possible. So, remote monitoring is very suitable for patients that do not need frequent device reprogramming.

Although attempts have been made to recognize those patients who rarely need pacemaker reprogramming, they have, so far, proven difficult to identify. One known factor is time after device implantation; the need for pacemaker reprogramming has been shown to decline with the time after implantation. Another factor that influences reprogramming rates is the age of the patient. The older the patient, the lower the need for reprogramming [2,3]. As shown in our previous work, device reprogramming was least often required in patients after device replacement due to battery depletion [4]. These patients are usually older and the set-up of the new device is often very similar to the replaced one, which had previously been optimized for patient.

Both, outpatient visits and remote monitoring, bring the patient the same benefit, however, the costs of them are very different. Pharmacoeconomic evaluation is a method that compares the costs and benefits of 2 or more therapeutic options, to identify the one that is more cost effective. The goal of this work was to use pharmacoeconomic analysis to evaluate, from the perspective of the health care payer in the Czech Republic, which type of patient follow-up (outpatient visits vs. remote monitoring) was more cost effective, in a group of patients after pacemaker replacement.

Methods

We carried out a retrospective analysis of patient files after pacemaker replacement between 2002 and 2005, who attended the Cardiocenter of University Hospital Kralovske Vinohrady. All visits from 2002 to 2015 were analyzed and visits were categorized as *scheduled* or *unscheduled*, or as visits with *action* (a change in device settings) or visits *without action* (no changes in device settings) – for more details see [4].

To determine cost-effectiveness, a cost minimization analysis was used. The pharmacoeconomic model was based on the assumption that: total benefit = costs of outpatient management – costs of remote management [these costs consisted of (a) the cost of remote follow-up, (b) the cost of outpatient checkups for problems detected during remote monitoring, and (c) the cost of unplanned outpatient visits]. Costs of outpatient visits and remote monitoring were set in Czech crowns (CZK) in the particular years covered and were counted together without discount. Costs of outpatient

management, for a particular year(s), was/were calculated as the product of the “code value” associated with the check-up for a specific pacemaker device (in CZK) (e.g., code 17292 (single) or 17294 (dual) chamber device) and the number of checkups carried out. If the value of the code changed during a 1-year period, the weighted average was used. Weights were the number of months in which the specific code value was in effect (see Table 1).

For calculation of remote monitoring costs, codes 17701 (together with code 0193659 for the remote monitoring unit) and 17702 were used. Because codes 17701 and 17702 were used for the first time in 2014, their theoretical values for the previous years were calculated from the average weighted drop of code values 17292 and 17294 (3rd column of Table 1). Weights were the numbers of visits with particular codes during the full follow-up period (visits with code 17292 accounted for 13% of all visits). The costs of remote monitoring units were not adjusted for the years 2002–2013, because they would not have been lower, instead, they would have been higher compared to their costs in 2015 (for example the costs of a remote monitoring unit was 29,900 CZK in 2014 compared to 27,195 CZK in 2015). For these reasons, these costs were set to 27,195 CZK, which was an average cost of remote monitoring units, from different manufacturers, in 2015. The costs of outpatient checkups for problems detected during remote follow-up and costs for unplanned outpatient visits were calculated as the product of the code value for a check-up of specific pacemaker device (in CZK) times the number of checkups done in a particular year.

Results

During the analyzed period, a total of 217 device replacements were performed. The median patient age was 76 years and most had coronary artery disease. Twenty-five percent were pacemaker dependent and the leading indication for device implantation was sick sinus syndrome (43%). About half of the patients had a single chamber device, see Table 2 for more details.

Between 2002 and 2015 a total of 1407 out-patient pacemaker check-ups were performed. One hundred and seventy-three (12%) were *unscheduled*; of this group, pacemaker reprogramming was needed in 44 (25%) visits. On the other hand, there were 1234 *scheduled* out-patient visits of which only 53 (4%) visits required changes in device settings. In total, only 7% (97 from 1407) of patient visits after pacemaker replacement were associated with device reprogramming – see Table 3.

The cost of outpatient checkups was calculated for each of the years, with respect to the type of pacemaker. The number of these checkups is presented in Table 4. Check-ups for single chamber devices without sensor (code 17292) never accounted for more than 20% of all checkups in a particular year and represented 13% overall. Cost was calculated as the product of the “code value” associated with the check-up for a specific pacemaker device (in CZK) and the number of check-ups carried out. The total cost for outpatient management for 217 patients, in the period 2002–2015, was calculated to be 802,709 CZK.

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