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CIED implantation in elderly patients: a single-center experience

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Thanks to the development of new medical technologies and improvement in medical care the last decades are characterized by the growth of elderly's number. The median age of the world's population is increasing because of a decline in birth rates and a 20-year increase in the average life span during the second half of the 20th century. During 2000–2030, the worldwide population aged > 65 years is projected to increase from 6.9% to 12.0% worldwide,[1] and is projected to almost triple in developing countries.[2] The growing number of older adults increases demands on the public health system and on medical and social services. Chronic diseases, which affect older adults disproportionately, contribute to disability and diminish their quality of life. It especially refers to cardiovascular diseases which have an age-associated epidemiology.[3]

Published registries give limited information on age-dependent complication rates of cardiac implantable electronic device (CIED) therapy. Meta-analyses of randomized trials give more precise information on included patient cohorts, but do not necessarily reflect daily practice because elderly patients are often excluded from trials. Therefore, the individual risk of elderly patients has to be estimated on an individual case basis. In summary, the age of patients is not relevant regarding possible complications; thus, there is no age limit for CIED implantations.[4,5] Meanwhile, elderly patients may be at great risk of pneumothorax, lead perforation, or pocket dehiscence. Although guidelines related to cardiac arrhythmia therapies have been updates continually, there are no existing recommendations of treatments for elderly patients.[6,7]

We performed a study to investigate efficacy and safety of CIED procedures in the elderly in a single center. A total of 496 elderly patients (age ≥ 75 years) were included in this retrospective single-center clinical trial. Studied patients were operated in Astrakhan Federal Center for Cardiovascular Surgery (Astrakhan, Russia) during 2014–2017. They were included if they underwent device implantation.

All patients were administered a 1.0 g cephazolin solution I/V before a procedure. A procedure was performed under the local anesthesia using a commonly accepted standard with a pacemaker implantation in the right or in the left subclavian area. The choice of pocket location, venous access, lead's fixation type and pacemaker mode was made by a surgeon depending on a specific case. Electrocautery was routinely used in all implantations. Drainage was used in case of diffuse bleeding. A one day bed rest and a 2-hour cold and compression therapy were prescribed for all patients. Patients didn't receive bridging anticoagulation and we didn't stop antiplatelet and/or anticoagulant therapy before and after pacemaker surgery. Antibiotics continued in case of severe bleeding from device pocket and necessity to stay drainage.

Case studies including electrophysiological, implantation and follow-up protocols were analyzed. Patients were monitored for procedure related complications. A period of follow-up was 3 (3; 4) years. CIED implantation-related complications (primary endpoints), intraoperative details and hospital stay days (secondary endpoints) were studied. Quantitative variables were described as median (interquartile range, 25%; 75%).

Of the 496 patients, 371 (75%) were under 80 years old. The mean age of studied patients was 79 (77; 83) years, the oldest being 98 years. There was an indirect correlation between the number of implantation procedures and patient age (Table 1). The ECG findings at the time of implantation were as follows: complete atrioventricular block in 134 patients (27%), atrial fibrillation/atrial flutter in 129 patients (26%), ECG findings characteristic of sick-sinus syn-

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Table 1. Age distribution of device implantations in the elderly patients.

Type of device surgery	75–79 yrs (*n* = 288)	80–84 yrs (*n* = 116)	≥ 85 years (*n* = 92)
VVIR PM implantation	74 (26%)	50 (43%)	42 (46%)
DDDR PM implantation	165 (57%)	55 (47%)	42 (46%)
ICD DR implantation	10 (3.5%)	0	0
CRT-D implantation	0	0	0
VVIR PM reimplantation	10 (3.5%)	5 (4%)	6 (7%)
DDDR PM reimplantation	23 (8%)	6 (5%)	2 (2%)
ICD DR reimplantation	5 (2%)	0	0
CRT-D reimplantation	1 (< 1%)	0	0

CRT-D: implantable cardioverter-defibrillator providing cardiac resynchronization therapy; DDDR: dual chamber; ICD: implantable cardioverter-defibrillator; PM: pacemaker; VVIR: single chamber.

drome in 99 patients (20%), first or second-degree atrioventricular block in 99 patients (20%); PVC/VT in five patients (1%), His bundle branches block in four patients (< 1%). There were no specific ECG changes during the device surgery in other cases. The main indication for device implantation therapy was AV block (60%). Implantations of dual-chamber (DDDR), single chamber (VVIR) pacemaker and implantable cardioverter-defibrillator (ICD) were performed in 52.8%, 33.5% and 2% of implantation procedures respectively, including 58 (12%) reimplantations.

Our experience shows that a CIED type has age dependence. Patients under 80 years more likely had implanted DDDR PM; meanwhile, at the age of over 80 years, VVIR PM were implanted more frequently. This correlation is explained by the prevalence of AF at the elderly. If a patient had a sinus rhythm, we tried to implant DDDR generator at the most of the cases. In cases of poor clinical state and high risk of periprocedural complications we used VVIR PM regardless of sinus status.

Venous approach as well as cephalic vein cutdown or subclavian puncture appeared to be equivalent (55% versus 45%). Leads with passive fixation were used in 72.5% of cases. The length of hospital stay was 4 (5; 6) days.

A total rate of complications associated with device surgery was 12.3%. The most common complication was lead dislodgement/dysfunction (Table 2). Lead dislodgement/dysfunction was a most common complication in our trial observed in 4% of patients. Loss of capture and/or sensing usually was revealed at first three days after procedure and led to surgical revisions. Four cases of lead dysfunction were referred to the late complications demanding repetitive hospitalization.

Pocket hematoma (PH) is a common complication of implantations of cardiac electrophysiological devices with

Table 2. Procedure related complications.

Complication	75–79 yrs (*n* = 288)	80–84 yrs (*n* = 116)	≥ 85 years (*n* = 92)	Total (*n* = 496)
Death	1 (< 1%)	0	1 (1%)	2 (< 1%)
Pocket hematoma	4 (1%)	4 (3%)	2 (2%)	10 (2%)
Infection of the pocket	0	0	4 (4%)	4 (1%)
Lead dislodgement/ dysfunction	14 (5%)	2 (2%)	4 (4%)	20 (4%)
Myocardial rupture	1 (< 1%)	2 (2%)	0	3 (<1%)
Pneumothorax	8 (3%)	0	0	8 (2%)
Acute cardiac syndrome	3 (1%)	1 (1%)	0	4 (1%)
Delirium	9 (3%)	1 (1%)	0	10 (2%)

especially high rate in elderly patients. This correlation is usually associated with high prevalence of oral anticoagulation or antiplatelet treatment in this group. All the cases of PH (10 patients) were surgically treated. Our routine surgical technique, which includes careful surgical technique, earlier subpectoral pocket formation, electrocautery use and drainage insertion is quite tolerant of PH. In fact, there is no consensus about drainage use while pacemaker implantation. One of the arguments against such approach is a probable increasing risk of pocket infection (PI) after pacemaker surgery. Meanwhile, about 4500 CIEDs have been implanted in our center. A strategy to insert drainage in case of diffuse bleeding have been used for all these procedures with a total draining time no more than three days and antibiotic administration for this period. Pocket draining has to be used especially in cases of subfascial or subpectoral pocket localization, which has been shown in our earlier trial.[8] We have found no correlation between PI rate and drainage insertion rate.

It is important to be very careful to prevent wound infection in device surgery, especially for elderly patients. All the cases of pocket infection (four patients) were seen at the age over 85 years. Elderly patients have a thin subcutaneous fat layer. Elderly patients with cognitive dysfunction may touch the wound after the surgery and thus have greater risk of wound infection than those without cognitive dysfunction.[9] Another infection risk factor is a repetitive surgery, 12% of all device procedures in our study referred to re-implantations. Careful pocket cleaning by antiseptic solutions and PH prophylaxis are important issues of wound infection prevention.

In the literature, some studies showed that none of the implantation related complications were higher in elderly patients except pneumothorax.[10] We had to insert a chest drain in eight patients which increased the length of hospital stay and in two patients led to death. Higher incidence of

kyphosis and lower body weight in the elderly group may contribute to increased incidence of this complication. In some cases a cephalic access may be a first-line technique to prevent pneumothorax, especially during single chamber PM implantations.

Delirium was observed in 10 patients (2%) with complete AV block and low ventricle escape rate. It usually occurred during the first hours after DDDR PM implantation and was associated with high atrial rate transferred to the ventricles. In our opinion this condition may be explained by reperfusion encephalopathy. It resolved soon after PM reprogramming to VVI mode for 1–2 days and bet-blockers admission for the same period.

We performed a large study investigating CIED implantation strategy in the elderly in a single center. Its results showed that a patient age can't be a contraindication for device surgery. CIED implantations have low incidence of complications in the elderly and therefore should be performed if needed. Meanwhile a careful follow-up for the elderly patients is needed.

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