

A Novel Computerised Virtual Reality Permanent Pacing Implantation Simulator

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Abstract

Complications after insertion of a permanent pacemaker are related to training and experience. Traditionally experience is gained by trainee performing the procedure under the supervision of senior operators, which may result in prolong procedure time (PT) and fluoroscopy time (FT).

We assessed if a novel computer based virtual reality simulation (VRS) of permanent pacemaker lead placement reflects operator experience in pacemaker implantation.

Thirty-two subjects with different pacing experience constituted to our study population. The PT and FT on atrial (A) and ventricular (V) pacing leads placement on the VRS were recorded.

We found the group with pacing experience has shorter PT and FT in both A and V leads implantation when compared with the non-experienced group. The PT and FT in V lead implantations is even shorter in the more experienced subgroup when compared with the less experienced subgroup. We conclude that the performance on VRS does reflect operator experience in pacing system implantation.

1. Introduction

Since the early human pacemaker in 1960s, the number of implants has increased exponentially. In UK alone over 16,000 new permanent pacemakers were implanted annually (1). Lead placement related complications including high stimulation threshold, electrode displacement and perforation, are directly related to training and experience (2). The experience is traditionally gained by trainees performing the procedure under the supervision of senior operators. This may result in prolong procedure time and fluoroscopy exposure.

2. Objective

The aim of the study is to determine if a novel computer based virtual reality simulation (VRS) of

permanent pacemaker lead implantation module reflects operator experience in pacing lead implantation procedure time (PT) and fluoroscopy time (FT).

3. Methods

The VRS module (fig. 1) comprises a computer linked to a jig with pacing lead and stylet that can be turned and advanced or retracted to simulate lead manipulation. A simulated fluoroscopic view of a beating heart and pacing wire (fig. 2) is activated by a foot pedal and is displayed on monitor screen. The software allows the operator to change the shape of the stylet and to test the pacing parameters simply by clicking on the icon 'stylet' and 'analyzer' respectively. The PT and FT are automatically displayed on the monitor.

Figure 1. The Virtual reality simulator (VRS) of permanent pacing lead implantation.

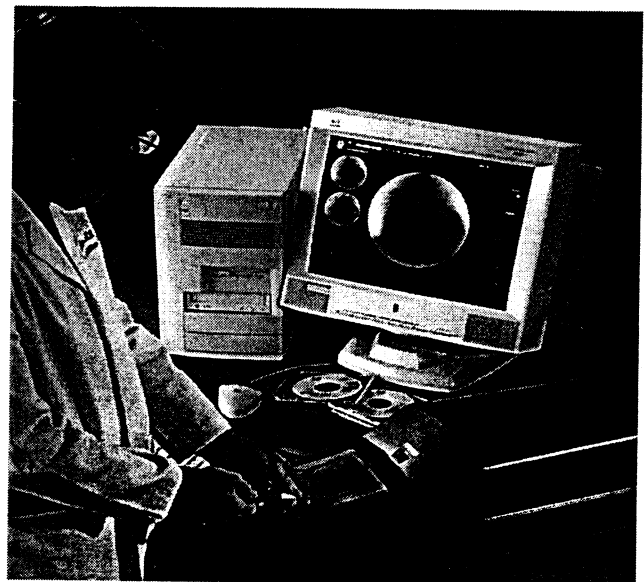
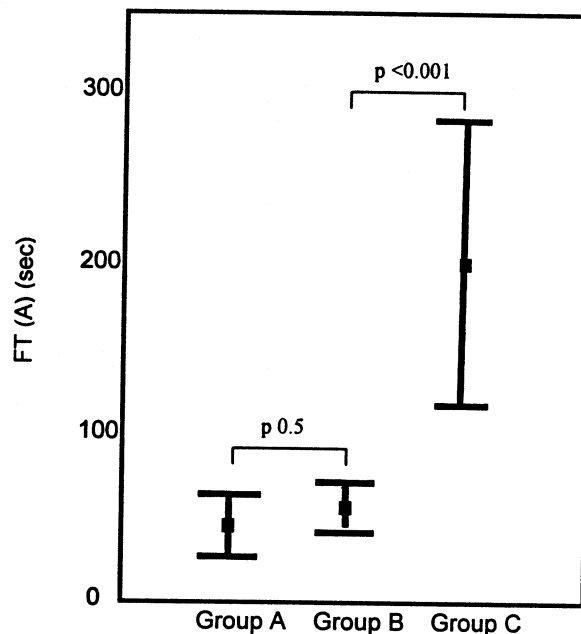
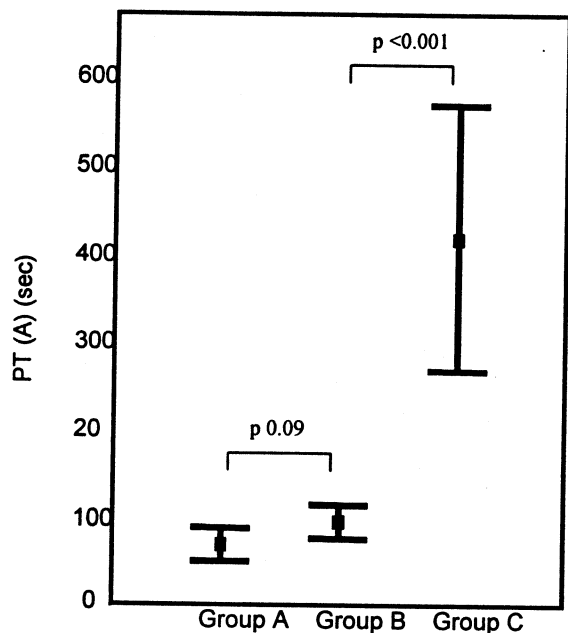


Figure 4. The error bar of atrial lead (A) placement PT and FT of the three groups.



5. Conclusion

Both FT and PT measured by VRS are related to operator experience. Interestingly A implantation appears simpler as judged by the lack of difference in FT and PT times of high and low volume operators which reflects most operators experience in practice. The VRS appears to closely reflect the real operation for pacemaker implantation. Further study is necessary to establish the role of the VRS module in the training of permanent pacemaker implantation.

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