

Interference between pacemakers/implantable cardioverter defibrillators and video capsule endoscopy

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Abstract

Our Letter to the Editor, related to the article "Small bowel capsule endoscopy in patients with cardiac pacemakers and implantable cardioverter defibrillators: Outcome analysis using telemetry" by Cuschieri *et al*, comments on some small errors, that slipped into the authors discussions. The given informations concerning the pacemaker- and implantable cardioverter defibrillators modes were inaccurate and differ between the text and the table. Moreover, as 8 of 20 patient's pacemakers were programmed to VOO or DOO ("interference mode") and one patient was not monitored by telemetry during capsule endoscopy, 9 of 20 patients (45%) lack the informations of possible interference between capsule endoscopy their implanted device. Another objection refers to the interpretation of an electrocardiogram (figure 1, trace B) presented: in contrast to the author's opinion the marked spike should be interpreted as an artefact and not as "undersensing of a fibrillatory wave". Finally, three comments to cited reviews were

not complete respectively not quoted correctly.

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Key words: Capsule endoscopy; Small bowel capsule endoscopy; Interference; Cardiac pacemaker; Implantable cardioverter defibrillator; Telemetry

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TO THE EDITOR

In our perception, small errors crept in the interesting article by Cuschieri *et al*^[1] "Small bowel capsule endoscopy in patients with cardiac pacemakers and implantable cardioverter defibrillators: Outcome analysis telemetry review". Therefore it should be subject to the following comments.

First of all, the informations concerning the pacemaker-/implantable cardioverter defibrillators (ICD)-modes, the devices were programmed into during the small bowel capsule endoscopy (SBCE), given in table 1 differ from the informations in the text: whereas the text referring to table 1 contents the information, that "three were set to DDD, six to DDDR, one to DOO, four to VOO, one to VVIR, and one to AAI→DDD (table 1)", the presented table 1 shows three set to DOO, no one was set from AAI to DDD and five were set to VOO [Pacemaker-Code (North American Society of Pacing and Electrophysiology-NASPE and British Pacing and Electrophysiology Group-BPEG: the first letter identifies the chamber paced, the second letter identifies the chamber sensed: V - ventricular, A - atrial, D - dual; the third letter identifies the response to sensing: I - inhibited, T - triggered, D - dual; the fourth letter identifies

the response rate (R)]. The error may partially result from the fact, that the authors did not clearly understand the different meaning of the “→” and the “↔” arrows. “AAI ↔ DDD” does not mean a change in programming, but describes a novel pacemaker function, allowing to change from the AAI- to the DDD-mode automatically, if necessary, and it describes the “managed ventricular pacing” function in Medtronic-pacemakers.

As a second remark, the study included 20 patients, in 8 of whom the pacemaker were programmed to VOO or DOO. In these modes (“interference mode”), pacemakers revert to noise-mode function stimulating the ventricle (VOO) or atrium and ventricle (DOO) without sensing the native rhythm. Additionally, one patient (DDD-Mode, table 2) was not monitored during capsule endoscopy (CE). Consecutively, in 9 of 20 patients (45%) the question of the study, in how far SBCE would influence pacemakers, could not be answered, as the pacemakers cannot be influenced at all. Considering to our study^[2] without evidence of interference between CE and implantable cardioverter defibrillators (ICDs) it remains unclear, why the sensing function of the ICDs was turned off.

The third objection refers to the spike in figure 1, trace B, preceding the third (narrow) QRS-complex: QRS-complexes # 4, 5 and 6 are clearly stimulated, proving that ventricular stimulation works well in this patient. So the stimulus preceding QRS-complex 3 cannot be a ventricular one, because it should be able to capture the ventricle. There is no pacemaker-system available with mode switching to AAI or AOO. So if mode switch was the reason for this spike, it must stimulate the ventricle. Moreover: the orientation of this “spike” is exactly antipodal (positive in lead 1, negative in lead 2) compared with the orientation of the effective ventricular spikes (negative in lead 1, positive in lead 2), this is most unlikely in conventional holter/telemetry recordings, usually you find same polarities for atrial and ventricular spikes in surface electrodes. So this “spike” should be interpreted as an artefact.

In two patients, the authors assumed “inappropriate pacer spikes due to undersensing of very subtle atrial fibrillation”, and they mentioned, that similar episodes were documented before and after CE. In this context, it would be interesting, if those patients suffered from paroxysmal, persistent or permanent atrial fibrillation. In the opinion of the authors “the mostly likely possibility is that the thresholds for atrial pacing were set too high”. According to this presumption, further details to the programming of the pacemakers should have been presented.

Another concern against the study of Cuschieri *et al*^[1]

is that there is only a few number of patients left (11/20) for the (real) investigation of interference between CE and devices to be able to derive their conclusions from their data.

Finally, there are three comments to the cited references: (1) The radiated power of CE is mentioned with 50 nW. The reference cited in this connection is wrong. CE is not mentioned in this article^[3]; and (2) In our study for interference between CE and ICD^[4], we “electrically simulated the situation in a patient”. The pacemakers and CE were placed in a saline solution (resistivity corresponding to that of low frequency range of muscle tissue), not water, in analogy to a study, in which the interference behaviour of mobile phones with respect to pacemakers was investigated^[5]; and (3) The authors discuss that “it is conceivable that the site of entry for the noise signals is the unshielded part of the connector block which could occur, as the swallowed CE passes posterior to the heart while descending through the esophagus, consisting with studies on mobile phones”, as a possibility for interference between CE and devices. Cited references for this hypothesis are the study of Dubner *et al*^[6] and our study^[4]. In none of the cited studies mobile phones were used.

REFERENCES

- 1 Cuschieri JR, Osman MN, Wong RC, Chak A, Isenberg GA. Small bowel capsule endoscopy in patients with cardiac pacemakers and implantable cardioverter defibrillators: Outcome analysis using telemetry review. *World J Gastrointest Endosc* 2012; **4**: 87-93 [PMID: 22442746 DOI: 10.4253/wjge.v4.i3.87]
- 2 Bandorski D, Irnich W, Brück M, Kramer W, Jakobs R. Do endoscopy capsules interfere with implantable cardioverter-defibrillators? *Endoscopy* 2009; **41**: 457-461 [PMID: 19353490 DOI: 10.1055/s-0029-1214610]
- 3 Kolb C, Schmieder S, Lehmann G, Zrenner B, Karch MR, Plewan A, Schmitt C. Do airport metal detectors interfere with implantable pacemakers or cardioverter-defibrillators? *J Am Coll Cardiol* 2003; **41**: 2054-2059 [PMID: 12798581 DOI: 10.1016/S0735-1097(03)00424-8]
- 4 Bandorski D, Irnich W, Brück M, Beyer N, Kramer W, Jakobs R. Capsule endoscopy and cardiac pacemakers: investigation for possible interference. *Endoscopy* 2008; **40**: 36-39 [PMID: 18067067 DOI: 10.1055/s-2007-995353]
- 5 Irnich W, Batz L, Müller R, Tobisch R. Electromagnetic interference of pacemakers by mobile phones. *Pacing Clin Electrophysiol* 1996; **19**: 1431-1446 [PMID: 8904533 DOI: 10.1111/j.1540-8159.1996.tb03155.x]
- 6 Dubner S, Dubner Y, Gallino S, Spallone L, Zagalsky D, Rubio H, Zimmerman J, Goldin E. Electromagnetic interference with implantable cardiac pacemakers by video capsule. *Gastrointest Endosc* 2005; **61**: 250-254 [PMID: 15729234 DOI: 10.1016/S0016-5107(04)02834-2]

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