

Twiddler's syndrome after implantation of baroreflex activation therapy: a case report

Daniel Dalos *, Cesar Khazen, Christoph Schukro, and Marianne Gwechenberger

Division of Cardiology, Department of Internal Medicine II, Vienna General Hospital, Medical University of Vienna, Waehringer Guertel 18-20, 1090 Vienna, Austria
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Background

Twiddler's syndrome is a rare complication after implantation of cardiac pacemakers or cardioverter-defibrillators that usually occurs within the first year after the procedure. However, it has not yet been described following implantation of baroreflex activation therapy (BAT).

Case summary

A 61-year-old female patient was referred to the cardiology outpatient clinic due to uncontrolled arterial hypertension despite maximal doses of several established drugs. Therefore, right-sided BAT implantation was successfully performed in February 2017 with good clinical response. Because of sustained neck pain at the site of stimulator, surgical revision was performed in November 2019 including a switch of the lead to the contralateral position. Approximately 1 month later, Twiddler's syndrome was identified on the basis of recurrent pain at the generator site necessitating pocket-revision, however, the lead was only untwisted but not replaced. A few weeks afterwards, unfortunately, lead revision was indispensable due to lead fracture.

Discussion

This case presents the uncommon phenomenon of Twiddler's syndrome after BAT implantation. In addition, the commonly twisted lead should always be replaced as well during surgical pocket-revision in order to ensure proper long-term function.

Keywords

Baroreflex activation therapy • Twiddler's syndrome • Lead fracture • Case report

Learning points

- Twiddler's syndrome may not only occur after implantation of pacemakers or cardioverter-defibrillators but also following implantation of baroreflex activation therapy.
- Surgical pocket-revision should always be combined with lead replacement in order to avoid additional procedures due to lead fracture and to ensure proper long-term function.

Introduction

Baroreflex activation therapy (BAT) is a promising new therapeutic option in patients with hypertension^{1,2} and heart failure (HF).³ Carotid

baroreceptor stimulation activates centrally mediated reduction of sympathetic activity while increasing parasympathetic activity. The lead is fixed at the carotid bifurcation, subcutaneously tunnelled, and connected with the generator that is usually placed in a pectoral pocket.

* Corresponding author. Tel: +43-1-40400-46140, Fax: +43-1-40400-42160, Email: daniel.dalos@meduniwien.ac.at

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Twiddler's syndrome is described as a malfunction of implanted devices due to manipulation and twisting around its axis within the device pocket with consecutive lead dislodging. It was primarily reported by Bayliss et al.⁴ in 1968 after implantation of a transvenous pacemaker (PM), and was, in addition, observed after implantation of transvenous implantable cardioverter-defibrillators (ICD),⁵ or even subcutaneous ICD systems,⁶ which commonly leads to insufficient pacing or inappropriate ICD therapy delivery.⁵⁻⁸ Furthermore, this rare complication may occur in neurological⁹ or anaesthesiologic devices¹⁰ and was described following implantation of BAT by Galand et al.¹¹ for the first time.

Timeline

February 2017	Baroreflex activation therapy implantation (sub-pectoral) with a right-sided electrode
November 2019	Surgical revision of the device (subcutaneous) and the lead (left side)
December 2019	Twiddler's syndrome—pocket-revision and lead untwisting (without revision)
January 2020	Lead revision due to lead fracture

Case presentation

A 61-year-old female patient presented with a medical history of herniated discs as well as inherited plaque psoriasis. Essential arterial hypertension was diagnosed several years ago after the exclusion of secondary causes. The patient already received full doses of antihypertensive drugs (olmesartan 40 mg, bisoprolol 10 mg, amlodipine 10 mg, rilmenidine 2 mg, spironolactone 100 mg, torasemide 20 mg, and hydrochlorothiazide 25 mg) and even underwent renal denervation twice until the indication for BAT implantation was made in January 2017 according to the applicable guidelines at that time.¹² At this time, there was no evidence of any late complications due to hypertension. Baroreflex activation therapy implantation (CVRx[®] Neo, Minneapolis, MN, USA) was successfully performed in general anaesthesia in February 2017, where the lead was fixed at the bifurcation of the right carotid artery and the device was placed into a retro-pectoral pocket due to the lean patient constitution [body mass index (BMI) 19.1 kg/m²] (Figure 1A).

Outpatient follow-up visits were performed on a regular basis every 3–4 months with a consecutive improvement of systolic and diastolic blood pressure values (Table 1).

In November 2019, the patient presented with progressive pain at the site of the electrode, which was reproducible on palpation and when the patient turned her head in both directions, which finally resulted in a surgical revision procedure. The existing lead was removed from the right side and a new one was

placed contralaterally at the bifurcation of the left carotid artery. In addition, the generator was removed from the deep origin below the right major pectoral muscle and the same device was re-implanted subcutaneously because of slightly gained body weight (BMI 20.9 kg/m²). A few weeks later, the patient returned again because of painful sensations at the area of the generator and, although any manipulation has been denied, an immediately performed X-ray revealed a twist of the device of 180° around its transverse axis with multiple loops of the lead (Figure 1B). Therefore, pocket-revision was performed in December 2019, and the existing lead was untwisted, but not replaced due to good technical values, and, finally, re-conducted with the generator without any complications.

At the time of the next scheduled outpatient visit 1 week after the procedure, stimulation impedance was below an acceptable threshold indicating lead fracture and, therefore, another surgical revision was unavoidable and was performed in January 2020 (Figure 1C). The existing lead was removed, and the novel one was successfully fixed at the same point at the left carotid bifurcation.

Four months later, the patient presented in a stable clinical condition without any pain or signs of infection in relation to the BAT device with inconspicuous technical values.

Discussion

Twiddler's syndrome represents a rare complication after PM or ICD implantation that usually occurs within the first year with an incidence of 0.07–7%.¹³ In 2016, this complication following BAT implantation was described for the first time in a patient with HF.¹¹ In contrast to our case, that patient kept manipulating the device resulting in lead fracture but declined any reintervention.

Over the last years, several risk factors have been identified for the development of Twiddler's syndrome such as female gender,^{8,14} older age,¹⁴ increased BMI,^{8,14} mental disorders,¹⁵ or a mismatch between the device and the size of the implantation pocket.¹⁶ Consecutive device dysfunction may result in life-threatening conditions due to insufficient pacing or inappropriate shock delivery in PM or ICD patients.^{5-8,16} Although this was not an issue in our case of BAT, suboptimal device positioning at the time of generator and lead relocation might have contributed to early Twiddler's syndrome only a few weeks afterwards. The generator was placed in a more subcutaneous position despite the fact that the initial position was sub-pectoral due to the patient body constitution. Placing the device under the pectoral muscle has previously shown to prevent Twiddler's syndrome, and the use of Dacron patches may additionally reduce this risk as tissue growth around the device is accelerated.^{15,17}

Twiddler's syndrome without lead breakage has been recently described in a deep brain stimulator device.¹⁸ Despite several coils lead impedance was still within normal ranges, also after untwisting, but, nevertheless, the surgeons decided to replace the lead to minimize the possibility of acute re-coiling with consecutive lead fracture. Therefore, despite good technical values after untwisting, the lead

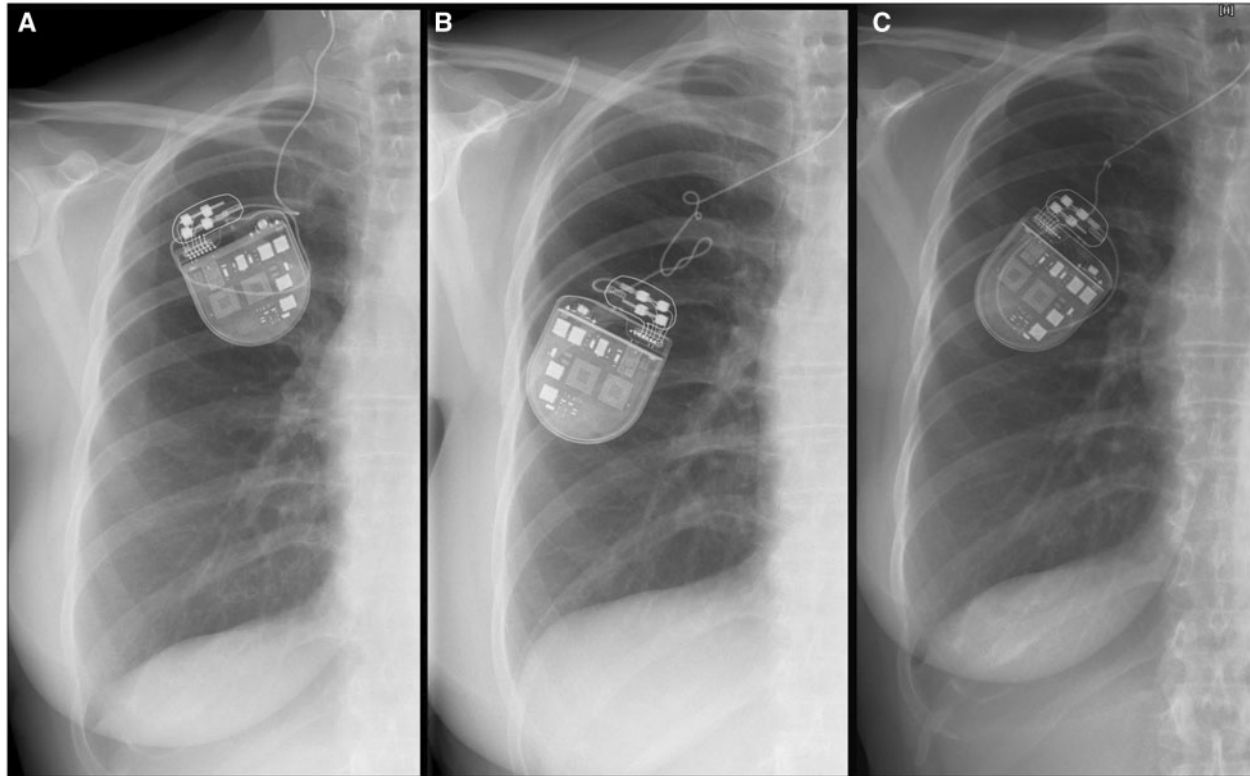


Figure 1 Successful baroreflex activation therapy implantation with a right-sided electrode (A). Twiddler's syndrome and multiple loops of the left-sided electrode (B). Generator and lead position after surgical revision (C). BAT, baroreflex activation therapy.

Table 1 Blood pressure development

	Prior to BAT	Rt BAT	Lt BAT	Lead fracture	After revision
Blood pressure, mmHg	220/124	152/125	170/140	218/136	171/120

BAT, baroreflex activation therapy; Lt, left-sided; Rt, right-sided.

should always be replaced, also in BAT devices, in order to ensure appropriate device function.

Finally, the following numbers describe the quantity of devices that have been implanted at the Medical University of Vienna in 2018: PM ($n = 403$), cardiac resynchronization therapy (CRT)-PM ($n = 39$), ICD (including subcutaneous ICD, $n = 162$), CRT-ICD ($n = 74$), and BAT ($n = 10$).

Conclusion

Twiddler's syndrome may also occur after implantation of BAT devices. Surgical pocket-revision, with an optimized implantation technique, should always be combined with lead replacement in order to avoid additional procedures due to lead fracture.

Lead author biography



Dr Daniel Dalos graduated from the Medical University of Vienna, recently finished his PhD, works as a specialist in internal medicine at the general hospital in Vienna and is currently in training for cardiology. His scientific interests contain heart failure with preserved ejection fraction, hypertrophic cardiomyopathy as well as implantable cardiac devices.

Supplementary material

Supplementary material is available at *European Heart Journal—Case Reports* online.

Slide sets: A fully edited slide set detailing this case and suitable for local presentation is available online as [Supplementary data](#).

Consent: The authors confirm that written consent for submission and publication of this case report including images and associated text has been obtained from the patient in line with COPE guidance.

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References

1. Bisognano JD, Bakris G, Nadim MK, Sanchez L, Kroon AA, Schafer J et al. Baroreflex activation therapy lowers blood pressure in patients with resistant hypertension: results from the double-blind, randomized, placebo-controlled rheos pivotal trial. *J Am Coll Cardiol* 2011;**58**:765–773.
2. de Leeuw PW, Bisognano JD, Bakris GL, Nadim MK, Haller H, Kroon AA. Sustained reduction of blood pressure with baroreceptor activation therapy: results of the 6-year open follow-up. *Hypertension* 2017;**69**:836–843.
3. Zile MR, Abraham WT, Weaver FA, Butter C, Ducharme A, Halbach M et al. Baroreflex activation therapy for the treatment of heart failure with a reduced ejection fraction: safety and efficacy in patients with and without cardiac resynchronization therapy. *Eur J Heart Fail* 2015;**17**:1066–1074.
4. Bayliss CE, Beanlands DS, Baird RJ. The pacemaker-twiddler's syndrome: a new complication of implantable transvenous pacemakers. *Can Med Assoc J* 1968;**99**:371–373.
5. Jabri A, Laiq Z, Nabeel Y. Twiddler's syndrome: an unusual cause of repeated shocks by implantable cardioverter-defibrillator in an asymptomatic patient. *Heart Views* 2019;**20**:118–121.
6. Camm CF, Rajappan K, Curson M, Tilling L. Twiddler's syndrome with a subcutaneous implantable cardioverter-defibrillator presenting with an inappropriate shock: a case report. *Eur Heart J Case Rep* 2019;**3**:1–5.
7. Morales JL, Nava S, Marquez MF, Gonzalez J, Gomez-Flores J, Colin L et al. Idiopathic lead migration: concept and variants of an uncommon cause of cardiac implantable electronic device dysfunction. *JACC Clin Electrophysiol* 2017;**3**:1321–1329.
8. Tseng AS, Shipman JN, Lee JZ, Mi L, Amin M, Killu AM et al. Incidence, patterns, and outcomes after transvenous cardiac device lead macrodislodgment: insights from a population-based study. *Heart Rhythm* 2019;**16**:140–147.
9. Jackowiak E, Patil PG, Chou KL. The deep brain stimulation "Twiddler Syndrome". *JAMA Neurol* 2019;**76**:620.
10. Shao J, Frizon L, Machado AG, McKee K, Bethoux F, Hartman J et al. Occlusion of the ascenda catheter in a patient with pump twiddler's syndrome: a case report. *Anesth Pain Med* 2018;**8**:e65312.
11. Galand V, Martins RP, Leclercq C. Twiddler's syndrome with a baroreflex stimulator device. *Europace* 2016;**18**:1433.
12. Mancia G, Fagard R, Narkiewicz K, Redon J, Zanchetti A, Böhm M et al. 2013 ESH/ESC guidelines for the management of arterial hypertension: the Task Force for the Management of Arterial Hypertension of the European Society of Hypertension (ESH) and of the European Society of Cardiology (ESC). *Eur Heart J* 2013;**34**:2159–2219.
13. Fahraeus T, Hojjer CJ. Early pacemaker twiddler syndrome. *Europace* 2003;**5**:279–281.
14. Boyle NG, Anselme F, Monahan KM, Beswick P, Schuger CD, Zebede J et al. Twiddler's syndrome variants in ICD patients. *Pacing Clin Electrophysiol* 1998;**21**:2685–2687.
15. Tahirovic E, Haxhibeqiri-Karabdic I. Twiddler's syndrome: case report and literature review. *Heart Views* 2018;**19**:27–31.
16. Spencker S, Poppelbaum A, Muller D. An unusual cause of oversensing leading to inappropriate ICD discharges. *Int J Cardiol* 2008;**129**:e24–e26.
17. Furman S. Defibrillator twiddler's syndrome. *Ann Thorac Surg* 1995;**59**:544–546.
18. Ghanchi H, Taka TM, Bernstein JE, Kashyap S, Ananda AK. The unsuccessful twiddler: a case of twiddler's syndrome without deep brain stimulator lead breakage. *Cureus* 2020;**12**:e7786.