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Original Research Article

Infective stent fractures with in-stent stenosis: Case series

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Abstract

Objective: To demonstrate incidence of infective coronary stent fractures and associated complications.
Materials and Methods: A retrospective case series study was conducted in a tertiary care centre over two years (2015 and 2016). Patients who had chest pain, fever and breathlessness post drug eluting stent (DES) deployment were evaluated. ECG-gated coronary Computed Tomography (CT) angiography was performed using GE-Optima 128 slice scanner and GE Light speed - 64 slice scanner. Patients with arrhythmia, high calcium score, contrast allergy and bare metal stent (BMS) deployment were excluded from the study.
Results: Out of the twenty-three patients evaluated post stent deployment five patients with drug eluting stent showed infective soft tissue, pseudo aneurysms with stent fracture and in-stent stenosis. Further follow up of these five cases post-antibiotic therapy for six weeks showed complete resorption of the infective soft tissue.
Conclusion: This study establishes that computed tomography has emerged as an excellent tool for post-stent deployment coronary imaging and as a worthier replacement for conventional angiography especially in infective scenarios.
Keywords: Aneurysm; Drug-Eluting Stents; Fracture Healing; Intra-operative Complications.

1. Introduction

With the availability of drug eluting stents (DES) there has been a significant reduction in rate of in-stent restenosis as compared to the counterpart Bare metal stents (BMS) but at the cost of delayed complications like stent fractures, in-stent stenosis and infections. [1] Stent fracture incidence rates were significantly underestimated either due to vague patient symptoms or due to inadequacy of conventional angiography but with the recent developments and the confidence in CT angiography more cases have been diagnosed and successfully treated with minimal complications. As the procedure does not require sedation or hospitalization, it is gaining popularity for follow up cases post stent deployment.

On reviewing the literature the growing incidence of stent fracture is a proof to higher detection rate by use of CT coronary angiography.

Stent fractures have been discussed in detail in the past, however the aim of this article is to emphasize on the infective aspect of stent fractures and how coronary imaging can successfully delineate the underlying pathology.

2. Materials and methods

2.1 Patient characteristics

A tertiary hospital based retrospective study was conducted over two years (2015-2016). Five symptomatic patients were identified from the pool refereed for post stent deployment imaging to evaluate cause of chest pain, breathlessness and fever. Location of stent was taken into account and stent type was identified from clinical and percutaneous transluminal coronary angiography (PTCA) database. All Drug eluting stents (DES) were identified as (Pronova SS, Endeavor, Taxus liberate, Pronova XR, Sirolimus coated stents). Conventional angiography was non-conclusive or indeterminate in these subjects and no stent fracture was suspected.

2.2 Coronary angiography protocol

ECG-gated coronary CT angiography was performed using GE-Optima 128 slice scanner and GE Light speed - 64 slice scanner. Preparation of patients included oral administration of 50 mg single dose of Tablet Betaloc (Metoprolol Tartarate) to achieve a heart rate of 60-70 beats per minute to optimize imaging. Few patients with tachycardia were put on a three day regime of tablet Ivabradine 5mg twice a day with meals to achieve the desired resting heart rate. Sublingual nitroglycerine spray was used for all patients immediately before the procedure. After pre contrast scanning, an ECG gated contrast enhanced scanning was performed with the protocol parameters as –

For GE 64 Light speed scanner: section thickness: 0.5mm; pitch: 0.225-0.240; rotation time: 0.4 sec; field of view: 180 cm; tube potential: 120 kV

For GE 128 Optima: section thickness: 0.5mm; pitch: 0.225-0.240; rotation time: 0.4 sec; field of view: 180 cm; tube potential: 120 kV

The tube setting was synchronized with the serial CT deviation numbers obtained from pre-contrast scan at the level of left atrium. An automatic triggering system was used with triggering occurring at identification of 140-160 HU at the aortic root after injection of 60-80 ml (as per dose of 1 ml per kg body weight) of Iohexol (Omnipaque, GE healthcare) at the rate of 4.5ml/ sec and flushed with 30 ml of normal saline. Source images were obtained and reconstructed and studied.

All images were interpreted by senior radiologist with 12-14 years of experience in cardiac CT. Observed characteristics were followed up and compared with medical data available. Follow up of the culture specimens was also documented.

3. Results

Out of the twenty three patients that were screened five symptomatic patients with DES deployment showed infective soft tissue with stent fracture and in-stent stenosis. (Table 1)

On average complications were diagnosed between 3 months to 1 year post procedure.

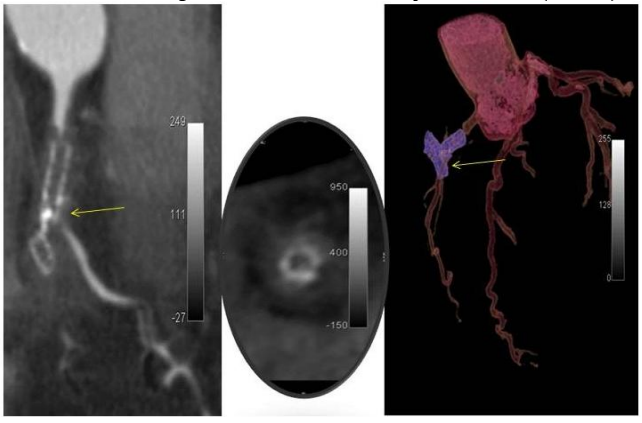
Table 1: Summary of five cases with associated complications

	Stent site	Stent fracture	Stent fracture type #	In-stent stenosis	Infective soft tissue	Pseudo aneurysm
Patient 1	RCA and LAD	+	IV	+	+	
Patient 2	RCA	+	IV	+	-	
Patient 3	RCA	+/-		-	-	+ Type 2
Patient 4	RCA	+	V	+	+	
Patient 5	LAD	+	IV	+	+	

*LAD-Left anterior descending; RCA-Right coronary artery ; # Single strut fracture is type I; More than 2 strut fracture is type II; More than 2 strut fracture with deformity is type III; stent fracture with transection but no gap as type IV; and fracture with a gap within is type V(Nakazawa G)

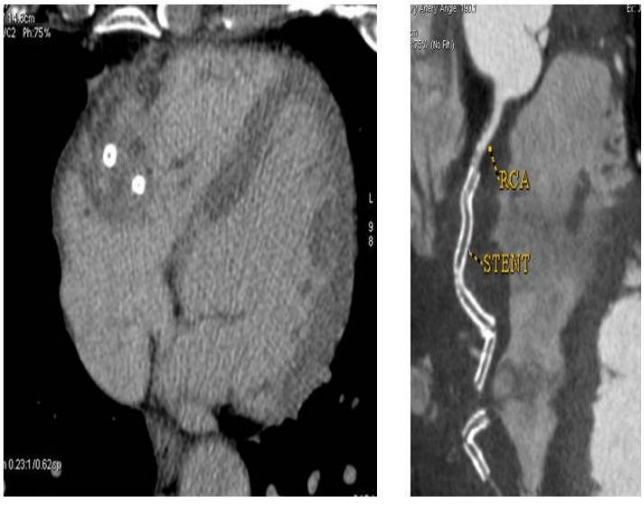
First case in our series had non conclusive conventional angiography but CT angiography showed significant bend in the stent secondary to in-stent stenosis indicating stent fracture due to infection. (Figure 1) Stent fractures due to immune reaction may be common with DES but due to infection are equally rare.

Figure 1: Multi-detector computed tomography Coronary angiography of a 45 year old male with history of RCA stent deployment 2 years back presenting with pyrexia of unknown origin (PUO) since 2 months: showing fractured stent with in-stent stenosis and peri-stent inflammatory soft-tissue (arrow).



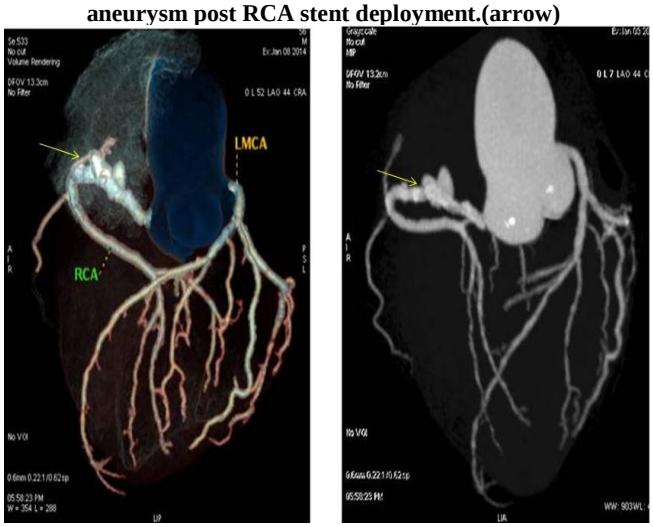
Second case revealed a two strut fracture of right coronary artery (RCA). (Figure 2) The fractures were seen involving the distal segments of RCA. There was no opacification noted within the stent indicating stent block. Intra-operative findings revealed infective stenosis.

Figure 2: Multi-detector computed tomography Coronary angiography: showing a two strut fracture with complete fracture at the mid part of the stent



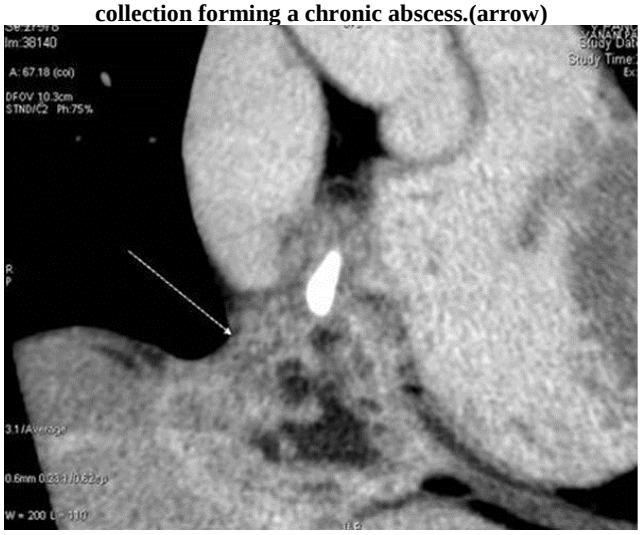
Infective pseudoaneurysm was diagnosed in the third case in proximal right main coronary artery at the proximal end of the stent and mid portion of the stent. (Figure 3)

Figure 3: Multi-detector computed tomography Coronary angiography with volume rendering: showing infective pseudo-aneurysm post RCA stent deployment.(arrow)



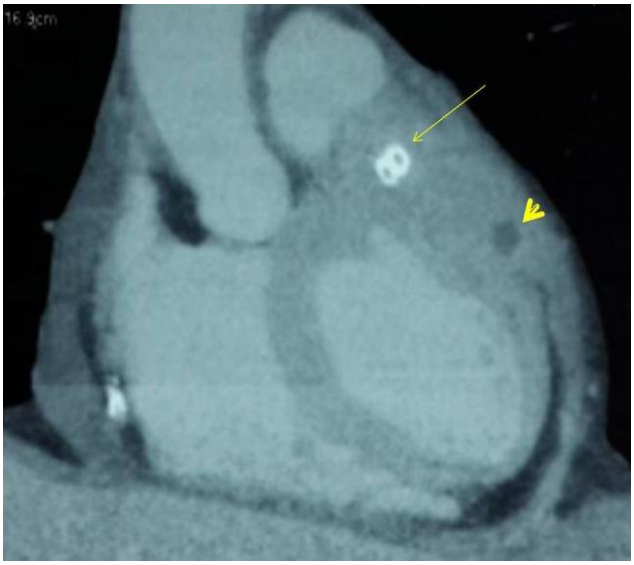
Fourth case was diagnosed as soft tissue on cardiac MRI, however, coronary CT lead to the diagnosis of peri-stent infection with stent fracture and on follow up post antibiotic therapy there was full resorption. (Figure 4)

Figure 4: Multi-detector computed tomography Coronary angiography: showing a peripherally enhancing collection with central necrosis around the RCA at the level of stent. The stent has perforated the RCA and was surrounded by fluid collection forming a chronic abscess.(arrow)



Fifth case of infective soft tissue along the LAD (left anterior descending artery) stent was diagnosed at our institute.(Figure 5) This patient also showed moderate amount of abnormal pericardial and myocardial enhancing soft tissue. Blood cultures reveal Staphylococcus aureus in most patients (four out of five)

Figure 5: Multi-detector computed tomography Coronary angiography: showing a peripherally enhancing collection with central necrosis (arrow head) around the LAD at the level of stent with stent fracture (thin arrow). Remarkable finding in this was an abnormal myocardial enhancement along with peripherally enhancing collection around the stent



4. Discussion

Our study clearly depicts the significance of coronary imaging in not only patient with suspicion of stent infections but also in patients who present with vague symptoms of chest pain and fever.

Percutaneous stent deployment is the commonest treatment for coronary revascularization and with the advent of DES even the risk of restenosis has reduced [1]. However delayed complications like stent fractures, pseudo-aneurysm formation, in-stent stenosis are coming into picture with the advent of MDCT coronary imaging facility. This article throws light on the possibilities and alerting the radiologist on what to expect when reporting post stent cases with complications.

Stent Fractures (SF): In literature the incidence of stent fracture ranges between 0.8 and 19%. [2] Stent fractures can be due to technical factors like balloon or stent overexpansion, stent overlap, stent length, inappropriate handling of stent or stent conformability.

A prospective study reported by Aoki et al of 256 patients having history of angioplasty with sirolimus-eluting stents evaluated with coronary angiography showed incidence of stent fracture to be 2.6% [3]. In the cases included in our study, all fractures were seen in sirolimus-eluting stents, however the handling of stents and appropriate length of stents was not taken into consideration in our study.

In stent stenosis with SF:

As proposed by Park KW et al. the explanation for the development of in-stent restenosis in case of SF is the poor distribution or interruption of drug delivery as a result of strut fracture that suppresses neointimal growth inhibition leading to intimal overgrowth and stenosis. [4] In our study, all cases with in- stent stenosis had underlying stent fractures of varying degree consistent with the above study.

Aneurysms with SF:

Limited cases have been reported of coronary artery aneurysms associated with DES SF which has an incidence of 0.2% in the DES as reported by Aoki *et al* [4].

Type I aneurysm:

Pattern of rapid growth with pseudo-aneurysm formation - presents within 4 weeks. Etiology of arterial injury related to the procedure is likely the cause rather than the delayed arterial response to the stent.

Type II aneurysm:

It shows "subacute to chronic" presentation. These cases are often detected during angiography for recurrent symptoms or during follow-up. Such presentation indicates chronic arterial response to a metal stent, polymer and/or drug to be the causative factor.

Type III aneurysm:

It refers to the infectious/ mycotic aneurysm.[4] Mycotic aneurysms with cultures showing Staphylococcus aureus after DES have been reported in the past.

In our study, patient presented with discomfort and chest pain but Multi-Detector Computed Tomography revealed an RCA stent pseudoaneurysm (Type III) with a suspicious underlying one strut stent fracture. In the past another case with LAD stent fracture and pseudoaneurysm case was diagnosed in our institute and treated with LIMA to LAD bypass graft post antibiotic therapy. Therefore, it is very important to detect the pseudoaneurysms early and plan further management.

5. Conclusion

Computed tomography has emerged as an excellent tool for post stent deployment coronary imaging. Cardiac CT has to be considered in clinics as a worthier replacement for conventional angiography especially in infective scenarios. Another key aspect of this study is describing the fractures and aneurysms by present standard classifications while reporting stent complications for uniformity. Coronary imaging and detailed reporting with a mention of the stent location, distance from ostia and fracture or aneurysm sub-type can make drastic difference to the consultant cardiologist at patient follow up and further management.

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