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## CT guided appendicectomy incision: A prospective case series



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## ABSTRACT

**OBJECTIVE:** Several radiological studies have suggested that the base of the Appendix often does not correspond with Mc Burney's point. The aim of our study is to assess the value of using CT localization of the appendicocaecal junction to guide placement of the appendicectomy incision.

**DESIGN & METHOD:** 32 consecutive patients, booked for open appendicectomy were prospectively included in this study. Coronal and axial CT scans with IV contrast were studied to assess site of the appendicocaecal junction. This information was used to guide placement of the incision.

**RESULTS:** 28 out of 32 patients studied, the appendicocaecal junctions were accurately identified. It was noted that the final incision sites were cephalad to Mc Burney's point in 8, at the point in 3 and caudal in 17. In 1 patient, it was necessary to extend the incision medially by 2 cm to retrieve the distal Appendix which had been detached through the site of rupture.

**CONCLUSION:** Mc Burney's point often does not correspond to the base of the appendix. We propose that using CT imaging to guide the appendicectomy incision is safe, facilitates locating the Appendix at surgery, minimizes incision size and decreases the need to extend it.

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## 1. Introduction

This paper documents a new technique, CT guided Appendicectomy incision, and the results of a prospective case series. It is reported as a case series, compliant with the process criteria [1]. Ever since Charles Mc Burney described the 'most sensitive point' in acute appendicitis, appendicectomy incisions have been placed in close relation to this site. Although Mc Burney stated 'the point described corresponds very accurately, in the living subject, to the base of the appendix' he had no imaging to confirm this; it was just his impression [2]. Surgeons know that using incisions based on this point, it is not uncommon to experience significant difficulty in locating the Appendix and discovering that the appendico-caecal junction is often not at that site. It is now clear by several radiologic studies that the base of the Appendix is not at Mc Burney's point in the majority of cases [3–5].

In order to minimize the difficulties of an inappropriately placed incision, we prospectively studied the CT scans in consecutive cases for open appendicectomy, to identify the appendico-caecal junction and the lie of the Appendix and used this information to guide placement of the incision.

## 2. Materials and methods

Thirty-two consecutive patients for open appendicectomy were studied prospectively. Once the decision to perform surgery was made, the patient was included in the study whether previous surgery, mass or perforation existed.

The CT examinations were done with IV contrast. Coronal and axial views were studied by both the surgeon and radiologist together to identify the appendico-caecal junction, the lie and course of the Appendix and their relationship to the bony pelvis, the anterior superior iliac spine, the umbilicus, the caecum, the iliac vessels and pelvic/abdominal viscera. This information was used to plan the siting of a muscle-splitting Lanz-type horizontal incision, placed in consideration of both the base of the Appendix and its course.

## 3. Results

Of the 32 patients, the appendico-caecal junction could not be identified with certainty in 4 cases. The remaining 28, our study population, consisted of 20 males, 8 females with age range of 12–47 (mean 28). Prior to surgery, the incision at the calculated site of the base of the appendix (using the images from CT scan; Fig. 1a,b) was marked on the skin with indelible ink (Fig. 1c). The skin incision ranging from 2–5 cm, was cephalad to McBurney's point in 8 cases (Fig. 2a,b), at the point in 3 (Fig. 3a–c) and caudal in 17 (Fig. 4a–c). Access to the base of the Appendix was straightforward and easy

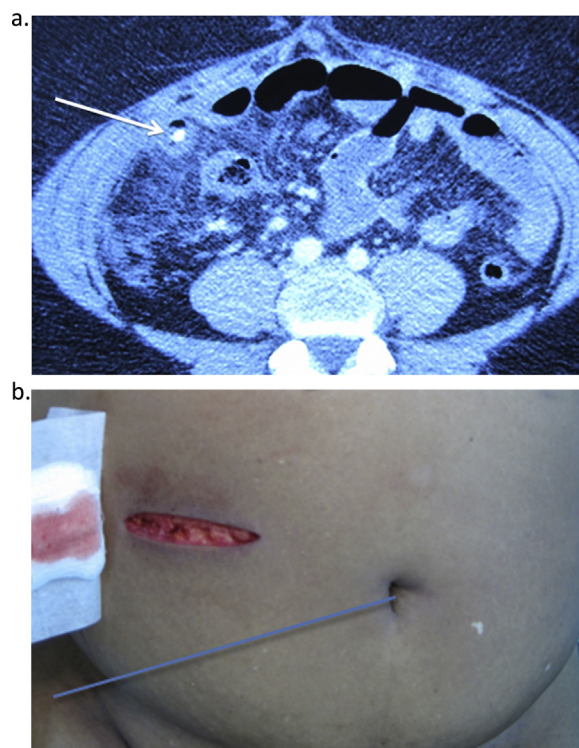
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**Fig. 1.** a) Axial CT scan with IV contrast showing the appendico-caecal junction (arrow), a thickened Appendix with enhancing walls, periappendiceal fat stranding and an appendicolith (Curved arrow). Extraluminal air is also present (arrowhead). b) Coronal CT scan with IV contrast showing a thickened Appendix with enhancing walls and periappendiceal fat stranding. The appendico-caecal junction (white arrow) is just superior and medial to the right anterior superior iliac spine measuring below the calculated McBurney's point (X). c) Showing the incision site marked on the skin with indelible ink, caudal to the calculated McBurney's point (X).

through the planned incision in all cases. In 1 patient it was necessary to extend the incision 2 cm medially to remove the distal half of a ruptured appendix (enveloped in omentum and pus) that was separated from the proximal part at the site of rupture with a free lying faecolith. The case in Fig. 2 demonstrates how difficult it might be, especially in an obese patient, to access the base of the Appendix via an incision placed at McBurney's point. Fig. 4 shows



**Fig. 2.** a) Axial CT scan with IV contrast showing an appendicolith (straight arrow) at the appendico-caecal junction at the level of the superior aspect of the umbilicus (dashed arrow). b) Showing the incision site cephalad to the calculated McBurney's point (X).

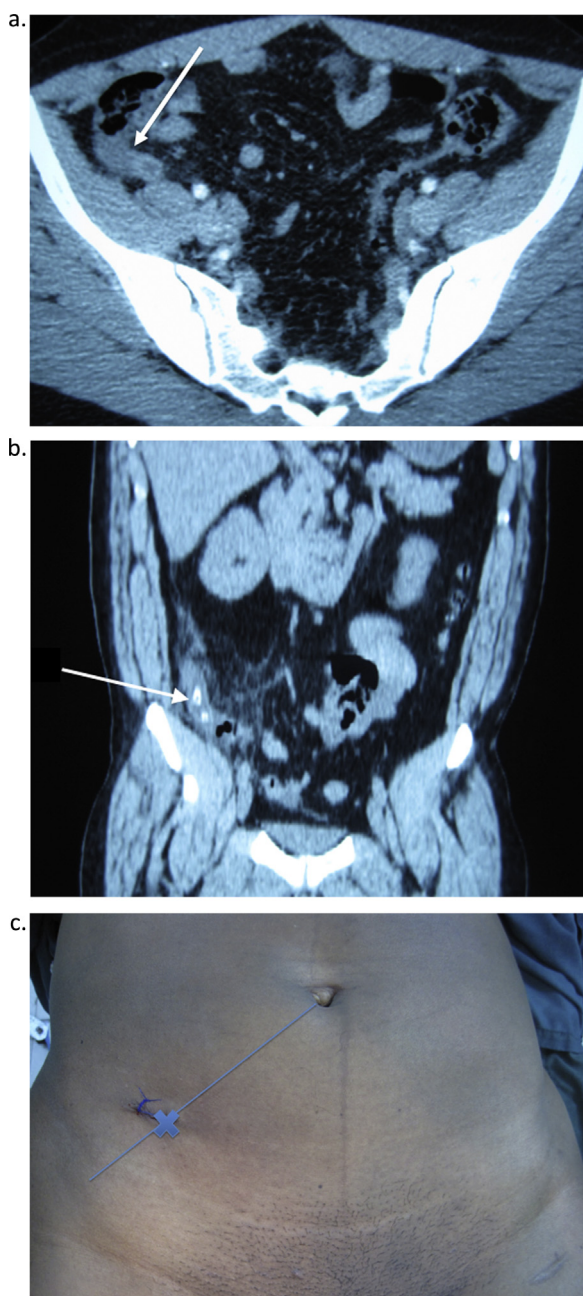
how deep in the pelvis the appendico-caecal junction might lie and how easy it would be approached by a CT-guided incision

#### 4. Discussion

Although Mc Burney stated that 'the point described corresponds very accurately in the living subject, to the base of the appendix,' this was done without imaging and was an assessment made by relating preoperative clinical examination to findings at surgery. Detailed imaging on CT and post evacuation barium enema shows the base of the Appendix to be away from Mc Burney's point in the majority of cases [5,6].

Yet, in spite of this, almost all descriptions of appendicectomy incisions still relate to Mc Burney's point [7,8]. McBurney himself, 3 years after describing his point, recommended a skin incision 'about four inches long' that 'crosses a line drawn from the anterior iliac spine to the umbilicus nearly at right angles about one inch from the iliac spine, and is so situated that its upper third lies above that line' [9]. Following his description, the Lanz, Rockey-Davis, Rutherford Morrison and the Fowler-Weir extension incisions all relate to McBurney's point [10].

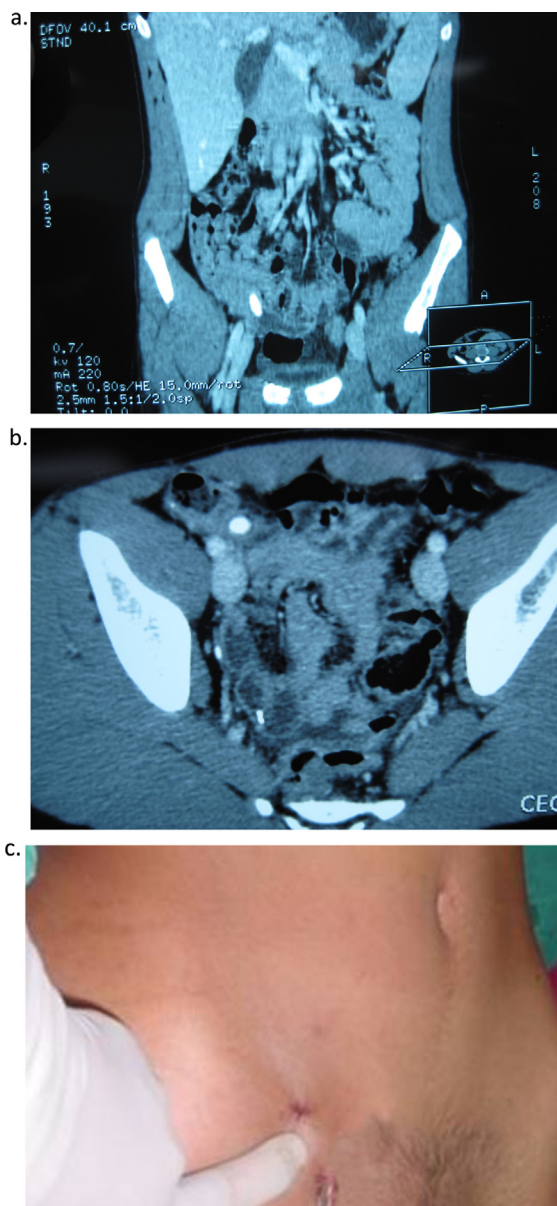
Now that we can, on CT, accurately identify the appendico-caecal junction and the lie of the appendix, we should use this image to guide our incision. In this study we were able to use it in 88% of cases, thus accurately placing the incision and facilitating easy identification of the appendix, its base, its position and consequently, minimize difficulties in locating the diseased organ and decreasing the need to extend the incision. In a retrospective study, reviewing CT scans in patients without appendicitis, Oto et al. concluded that if they had utilized the CT to locate the appendix, they would have made a different incision in 35% of cases undergoing appendicectomy [6]. In our prospective study, the incision was not at Mc Burney's point in 25 of the 28 cases (89%). Some authors empirically place the incision above or below Mc, Burney's point, using no



**Fig. 3.** a) Axial CT scan with IV contrast showing the appendico-caecal junction (arrow), a thickened Appendix with enhancing walls. b) Coronal CT scan showing a thickened appendix (arrow) with enhancing walls, peri-appendiceal fat stranding and two appendicoliths. The base of the Appendix is seen at McBurney's point. c) Showing the skin incision at the calculated McBurney's point (X).

objective means of locating the Appendix preoperatively [11,12]. In fact, without any attempt to identify the site of the appendix, one study recommends placing the incision cephalad to Mc Burney's point on the assumption that the base of the Appendix is more likely to be there [11]. The other, 'Bikini' incision, placed caudally, does not relate to the location of the Appendix but gives priority to a cosmetically acceptable incision with no consideration of where the Appendix actually is [12]. It seems obvious that since we can now accurately identify the appendico-caecal junction on CT in the majority of cases, we should use this modality to influence incision placement.

It could be argued that CT is costly and need not be done to diagnose appendicitis. However, there is considerable data show-



**Fig. 4.** a) The appendicocaecal junction, with a faecolith (arrow), lies well below and medial to McBurney's point (X). b) The appendicocaecal junction lies low in the pelvis (arrow). c) Small incision placed well below McBurney's point successfully locates the base of the appendix.

ing great diagnostic accuracy (90–98%) when CT is used [13,14]. Thus, CT can lower the negative appendectomy rate. Doing an unnecessary appendectomy is extremely expensive and exposes the patient to unnecessary risk and morbidity. Kryzauskas et al. had a misdiagnosis rate of 22.9% but used CT in only 3.4% of cases [15]. Arthur et al. reported a negative appendectomy rate of 19% of 1189 operations – that is over 200 unnecessary operations [16]. Misdiagnosis is therefore common and horrendously expensive relative to the use of CT in diagnosis.

One may also consider ultrasound as an alternative to CT for diagnosing appendicitis. However, CT has a much greater accuracy – a sensitivity of 92%, specificity of 85% and an overall accuracy of 90% compared to 69% for ultrasound [13].

While laparoscopy is emerging as the gold standard for appendectomy, open surgery is still widely practised in most developing countries. For example, in only 4 of 15 countries of the English-speaking Caribbean is laparoscopy available in the public hospitals.

Even where it is available, as in Trinidad and Tobago, over 75% of our appendicectomies are still done by open technique. Moreover, even in 2017, most appendicectomies are done open at University Hospitals in Poland, Iran and Lithuania [17,18,15]. Even in Sweden, although a trend from open to laparoscopy was shown in a 15-year study, up to 2014 more than 20% of their appendicectomies were done by open technique [19].

We support the view that, CT should be used in the diagnosis of appendicitis [13,14,20,21]. We are now proposing an additional use of the CT, especially since, in the developing world, most appendicectomies are still done by open surgery, not laparoscopy. Utilizing CT localisation is likely to result in a smaller incision, greater ease in locating the Appendix and minimal need for extending the incision, thus improving cosmesis and minimizing morbidity.

## 5. Conclusion

CT localisation of the appendico-caecal junction and the lie and position of the Appendix prior to appendicectomy is likely to result in a smaller incision, greater ease in locating the Appendix and minimal need for extending the incision.

## Conflicts of interest

The authors declare no conflicts of interest.

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## Ethical approval

Ethical approval was granted by the institutional ethics committee.

## Consent

Informed consent was obtained from all patients.

## Author contribution

All authors have contributed significantly in these case series. The first author have performed the surgery and rest of the authors helped in collecting data, designing, organizing to write the manuscript as well as assisted in critical analysing of the manuscript. All authors have approved the final version of this manuscript.

## Guarantor

The corresponding author and the first author (Professor Vijay Naraynsingh) will accept the full responsibility for the work.

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