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Cleland's ligaments and Dupuytren's disease

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Abstract

The aim of this study was to investigate whether Cleland's ligaments are affected by Dupuytren's disease and assess their contribution to the flexion contracture of the proximal interphalangeal (PIP) joint. Twenty patients with Dupuytren's disease undergoing fasciectomy for a PIP joint contracture > 40° (mean 61°, range 45°–100°) were included. After excision of all other identifiable digital disease, Cleland's ligaments were assessed. If they appeared to be macroscopically affected by Dupuytren's disease they were excised, sent for histological analysis, and any further improvement of PIP joint contracture was recorded. There were 14 males and six females with a mean age of 62 (range 40–79) years. Excision of Cleland's ligaments resulted in a mean further correction of 7° (range 0°–15°). Histological analysis indicated that Cleland's ligament was clearly involved with Dupuytren's disease in 12 patients, indicating that Cleland's ligaments can be affected by Dupuytren's disease. In the remaining specimens the histological findings were equivocal. As these structures are situated dorsal to the neurovascular bundles, a specific dissection has to be undertaken to identify them. Excision of Cleland's ligaments at digital fasciectomy further avoids leaving residual disease and may yield a worthwhile further correction of PIP joint flexion contracture.

Keywords

Cleland's ligaments, Dupuytren's disease, proximal interphalangeal joint

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Introduction

John Cleland, surgeon and anatomist (Figure 1a), was born in Perthshire in 1835. At the age of 15, he entered the University of Edinburgh to study medicine, completing his exams 1 year earlier than he was allowed to graduate. At the age of 28, he was appointed Professor of Anatomy and Physiology at then Queen's College in Galway, and in 1877, he took over as Professor of Anatomy at the University of Glasgow. Cleland's interests were diverse and he published on varied topics including osteology and the mesocolon, wombat, and female beaver (Cleland, 1860; 1869; 1909). He also published a book of poetry (1887). Cleland is best remembered, however, for his eponymous ligaments that he first described in a paper published in the *Journal of Anatomy and Physiology* (Cleland, 1878). In this paper, he describes strong ligaments extending from the sides of the phalanges into the skin that are particularly well developed at the middle phalanx, but also present distally and in the thumb (Figure 1b).

It has traditionally been accepted that Cleland's ligaments are not involved in Dupuytren's disease (Hurst, 2011; McFarlane, 1990). We could, however, find no published evidence to support this view. The aim of this study was to investigate whether Dupuytren's disease can affect the ligaments of Cleland and, if so, whether they contribute to the flexion contracture of the proximal interphalangeal (PIP) joint in this condition.

Methods

After obtaining consent, 20 patients with PIP joint flexion contractures > 40°, who were undergoing

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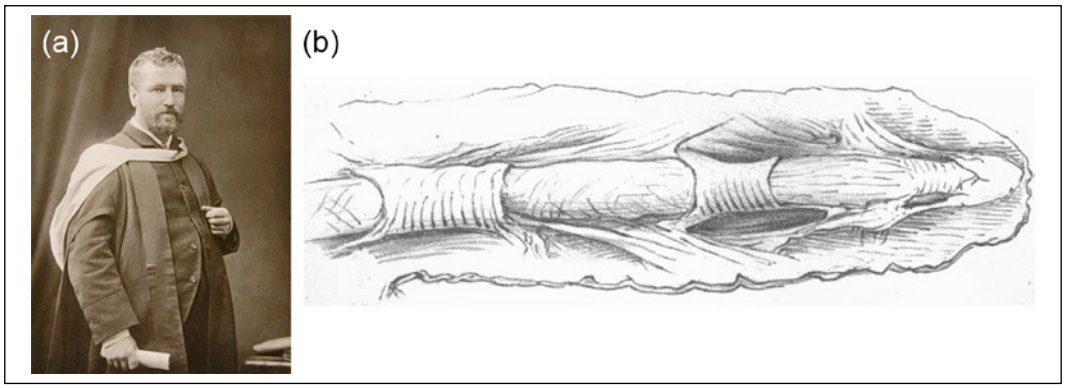

Figure 1. (a) John Cleland. (b) Cleland's original illustration of the digital fascia.

digital fasciectomy, were studied. There were 14 males and six females. The age range of patients was 40–79 years (mean 62.4 years).

All PIP flexion contractures were measured pre-operatively with a goniometer. Patients with a flexion contracture of < 40° were not included. Patients who were included in the study had a mean PIP contracture of 61° (range 45°–100°). The little finger was involved in 12 and the ring finger in eight patients.

After excision of all other identifiable disease, Cleland's ligaments were specifically dissected and assessed. If they appeared to be macroscopically involved, they were excised, fixed in formalin and sent for histological analysis. Specimens were stained with haematoxylin and eosin (H&E) dye.

Any improvement in the residual joint contracture was recorded using a sterile goniometer.

Results

Cleland's ligaments appeared to be involved in disease in 18 of the 20 patients studied (Figure 2). Three of those patients had bilateral macroscopic involvement.

Of the 21 ligaments excised, 14 ligaments in 12 patients had clear histological features suggestive of involvement with Dupuytren's disease (Figure 3). In the remaining specimens, the histological findings were equivocal.

After excision of the ligaments, an overall mean further correction of 7° was achieved (range 0°–15°). Of the patients in whom histological disease was confirmed in one or both ligaments, there was a mean correction of 10°. The correction for patients in whom the histology was equivocal was 4°. The number of cases was not adequate to make valid statistical conclusions regarding this difference.

The improvement was difficult to quantify exactly, as there was often a slight residual flexion contracture within the PIP joint, which, after excision of Cleland's ligaments, then corrected with a gentle stretch of the joint.

Of the patients in whom Cleland's ligaments were found to have histological involvement, there was a mean pre-operative PIP flexion contracture of 69° (range 45°–100°). Patients without involvement had a mean pre-operative contracture of 49° (range 45°–50°).

One patient with an initial PIP joint contracture of 100° had a residual extension deficit of 10° at surgery. The remainder all had full correction of the PIP joint at surgery. We did not perform surgical release of the PIP joint itself in any patient.

There were no complications from this surgery, and in particular, none from the excision of the affected Cleland's ligaments

Discussion

In his original paper (1878), Cleland reported that:

> *"Strong ligaments, hitherto undescribed, extend from the sides of the phalanges, near the phalangeal articulations, and are inserted into the skin, helping to retain the different parts of the integument in the positions which they are adapted to occupy."*

Grayson (1940) corroborated the observations of Cleland and wrote:

"But in addition to these structures it was apparent that there is also a fibrous septum volar to the digital vessels and nerves... Their distribution is such that they could obviously subserve precisely the same function as their deeper fellows."

Thomine (1972) described retrovascular bands of fascia in the foetal hand running from proximal to distal from the proximal and distal phalanges, citing the

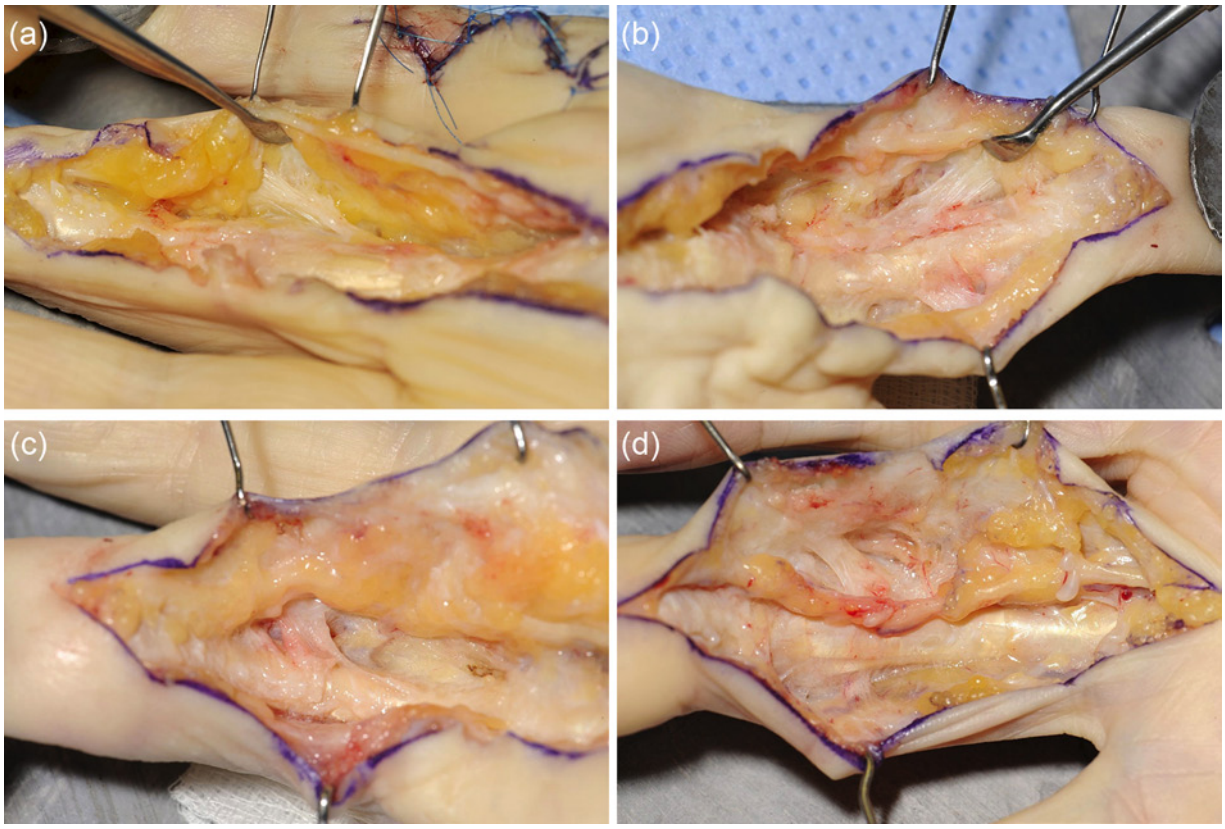

Figure 2. (a) Surgical dissection of Cleland's ligament, with the neurovascular bundle retracted. In this case it looks fairly normal, with a sheen to the fibres, which are clearly defined, and no thickening of the ligament. (b) Cleland's ligaments are visualized on each side with the neurovascular bundle retracted. They appear abnormal, with thickening and loss of definition of the fibres. (c) In this case, there is more obvious change, with thickening of the ligament, and the Cleland's cord appears to be contributing to the restriction of PIP joint extension. (d) In this dissection, the ligament on the radial side looks substantially thickened compared with the more normal structure on the ulnar side.

similar observations of Legueu and Juvara (1892) as corroboration, but without reference to Cleland. None of these authors made any reference to Dupuytren's disease.

McFarlane (1990) stated that:

> *"Grayson's ligaments are frequently, if not always involved in [Dupuytren's disease], whereas Cleland's ligaments are not."*

However, McFarlane observed that diseased tissue, which he called the "retrovascular cord of Thomine", resides dorsal to the neurovascular bundle. Although he thought that this tissue was superficial to Cleland's ligaments, he was unsure whether they were distinct structures. He argued that whether they were separate or not was academic, because the tissue had to be removed. Zwanenburg et al. (2013) observed in micro-dissections of fresh frozen fingers that at the PIP joint level, Cleland's ligaments consist of three layers. Fibres overlying the flexor tendon sheath, periosteum or joint capsule, and extensor expansion converge as they passed laterally to insert into the skin around the mid-lateral line.

Hitherto, it has thus been assumed that Cleland's ligaments are not affected by Dupuytren's disease. Hurst (2011) stated:

> *"Except for Cleland's ligaments, all of these structures can become pathological components of Dupuytren's cords."*

Although they do not become incorporated into the spiral cord, as do Grayson's ligaments, we have found that Cleland's ligaments are affected by Dupuytren's disease, forming separate retrovascular cords. We could not, however, detect two or three separate elements, as suggested by McFarlane and Zwanenburg et al. respectively, although this may have been obscured by the presence of disease.

These cords do appear to contribute to the PIP joint contracture, although an accurate quantification of this was difficult due to a frequent coexisting residual

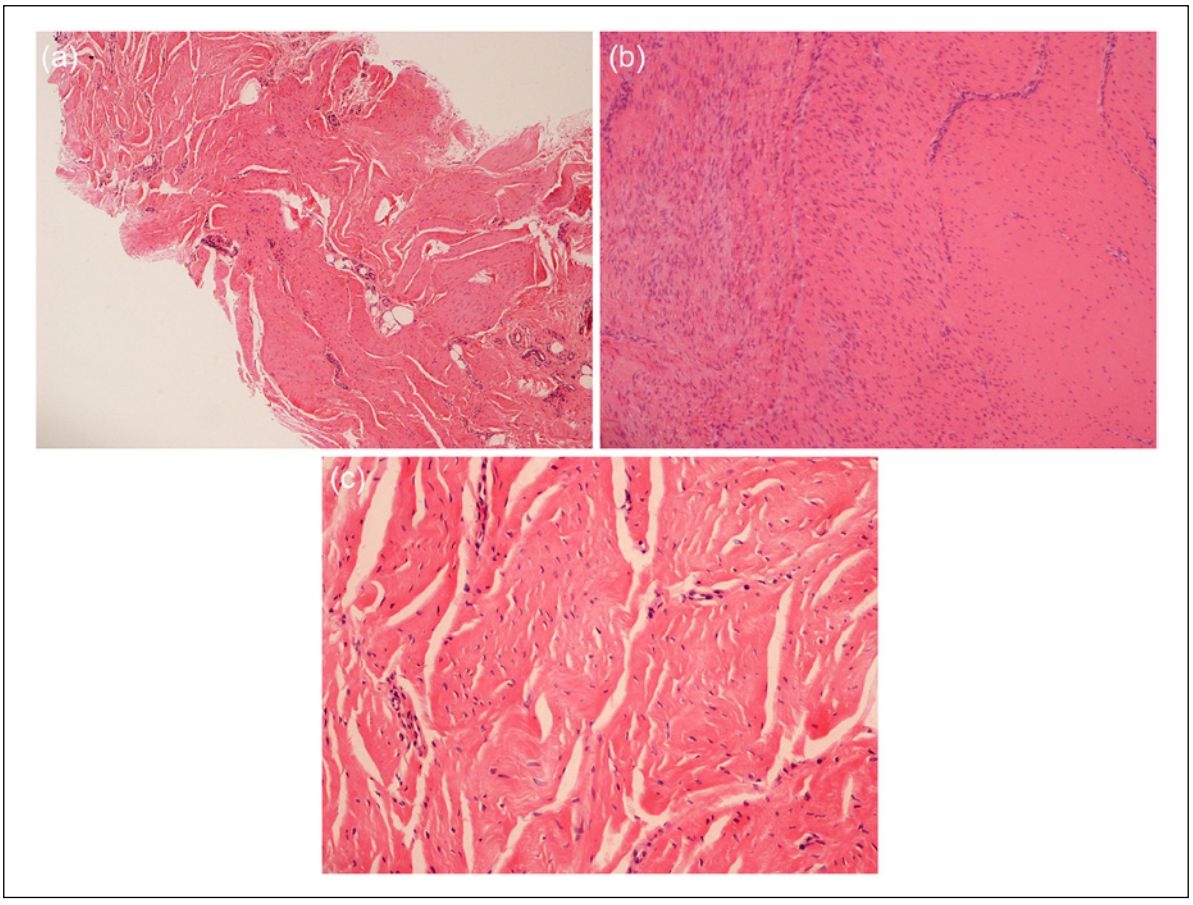

Figure 3. (a) Histological specimen of Cleland's ligament (H&E); viewed on low power (x 4) a degree of nodularity can be seen. (b) Viewed at higher power (x 10) areas of proliferating fibroblasts with a haphazard arrangement can be seen. (c) This higher powered view (x 20) shows a disorganized array of fibroblasts as seen in Dupuytren's disease.

flexion contracture of the joint itself. This was a confounding factor that could not be eliminated until the cord had been excised, and it was thus difficult to tell how much of the residual contracture was due to the involvement of Cleland's ligament and how much was due to stiffness of the underlying joint. Surgical release of the joint prior to cord excision was not thought to be justified, as after removal of all of the macroscopically obvious disease, a gentle stretch of the joint was sufficient for correction, without the need for more extensive surgery. It could be argued that the residual contracture would correct even with the diseased Cleland's ligament left in place. This, however, would result in residual disease being left in the digit, which may predispose to an early recurrence of the contracture. A further counterargument would be that, if the diseased ligament were left in place, the "post-surgery stretch" would be more likely to result in undesirable tearing of the tissues, even if the joint itself were released.

As these structures exist behind the neurovascular bundle, they may not be seen or excised unless a specific dissection is made. The neurovascular bundle has to be mobilized dorsally, taking particular care not to damage the digital artery, which is vulnerable during dissection.

The patients in whom Cleland's ligament was histologically involved with Dupuytren's disease had a greater mean pre-operative contracture than those in whom Cleland's ligament was not involved, either macroscopically or histologically. Although the numbers were small, this may reflect the more extensive disease pattern in these patients.

We would therefore recommend that, when digital fasciectomy is performed for a PIP joint flexion contracture, Cleland's ligaments should be inspected. If thought to have macroscopic involvement with Dupuytren's disease, we recommend that Cleland's ligaments be excised. If this is not done at digital fasciectomy, then there may be residual disease leading

to suboptimal correction and the possibility of an early recurrence of the contracture.

Conflict of interests

None declared.

Ethical approval/consent

As there was no change in treatment proposed we were advised that no ethical approval was necessary.

All patients were fully consented for the procedure as well as for having intraoperative photographs taken.

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