Clubbing

Introduction

The original description of clubbing was by Hippocrates in the 5th century BC in a patient with empyema. Clubbing came into the spotlight again in the 19th century when Eugen Bamberger and Pierre Marie described hypertrophic osteoarthropathy which is a frequently concomitant disorder. By the end of World War I clubbing was known to most physicians, usually as an indicator of chronic infection (Mangione, 2000).

Clubbing, the focal enlargement of the connective tissue in the terminal phalanges, is associated with a plethora of infectious, neoplastic, inflammatory and vascular conditions and the diagnostic implications of this sign are such that its presence should not go unnoticed or uninvestigated (*Figure 1*). As well as being associated with a host of conditions, in a paediatric setting, clubbing can indicate chronic conditions like cystic fibrosis or cyanotic forms of congenital heart disease. However, it is also important to remember that clubbing can be a benign sporadic hereditary condition (Myers and Farquhar, 2001).

Figure 1. Hands showing clubbed (beaking) fingernails in an elderly male patient. Clubbing (acropachy) of the fingers, with bulbous fingertips and curved nails, often occurs as a symptom of other disorders. In this case it was inherited.

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Clinical anatomy and pathophysiology

The dorsal portions of the distal phalanges are covered by a protective hard keratin cover, the nail plate. This is formed by nail matrix at the proximal end of the nail plate, creating the superficial layers while the nail matrix at the distal end creates the deeper layers. Any impairment in this production causes a distortion of the nail. For example disruption of production at the proximal end leads to superficial nail problems such as psoriatic pitting, and disruption of production at the distal end leads to deeper problems like ridging of the nail. A transient health problem during development of the nail plate leads to a transverse line across the nail – Beau's line (Fawcett et al, 2004).

Clubbing develops when there is increased vascularity in the nail bed leading to hyperplasia of fibrous tissue and oedema. This causes a thickening of the tissue beneath the nail plate giving the diagnostic criteria of loss of the hyponychial angle, fluctuance of the nail bed and the abnormal phalangeal depth ratio (Anonymous, 1975). It is usually painless and can involve both fingers and toes but can also be unilateral in certain conditions, for example arterial aneurysms and Pancoast's tumour and in some cases is even unidigital (Mangione, 2000).

Despite physicians having been aware of clubbing for centuries, the pathogenesis of the sign is still poorly understood. Mendlowitz (1941) and Mendlowitz et al (1971) showed that under conditions of maximal vasodilatation there is increased heat elimination from the fingertip and accelerated clearance of krypton-85 after injection into the finger pulp, thereby deducing that the increased blood supply to clubbed fingers exceeds tissue requirements (Anonymous, 1975). Currie and Gallagher (1988) studied post-mortem angiograms and concluded that this increased vascularity is a result of vasodilatation, not hyperplasia of vessels, as there were no anatomical differences between clubbed and control cases. Rush et al (1992) used thermography to show a rise in temperature by half a degree in clubbed fingers and Ward et al (1995) documented a higher glucose metabolism in clubbed fingers using positron emission tomography. These observations suggest that in patients with clubbing there is increased blood flow and metabolism within the distal phalanges.

Tissue hypoxia and genetic factors (such as those seen in familial clubbing) have both been suggested as the underlying cause (Schneerson, 1981). The 'neural reflex' theory suggests that the vagus nerve has a pivotal role in the aetiopathogenesis of clubbing. Afferent impulses travel via the vagus nerve from the inciting focus, e.g. a lung malignancy to the CNS, then via an unknown efferent path vascular changes are mediated leading to hypertrophy of the fibroconnective tissue. In some patients with inoperable bronchial carcinoma, division of the vagus nerve resulted in regression of clubbing (McPhee, 1990).

The 'toxic substance' theory suggests that a substance normally deactivated by the lungs is shunted and able to selectively act on the peripheral vasculature as a vasodilator. Substances implicated in this theory include oestrogens, ferritin, prostaglandins and growth hormone (Currie and Gallagher, 1988). The release of platelet-derived growth factor (PDGF) following impaction of megakaryocytes and platelets in the peripheral vasculature has also been suggested, as PDGF causes increased permeability of capillaries, fibroplastic activity and hyperplasia of smooth muscle. Fox et al (1991) found evidence to support this theory by finding platelet microthrombi in patients with clubbing.

Examining the hands

Clubbing has three diagnostic features:

1. Loss of the hyponychial angle
2. Fluctuance of the nail
3. Abnormal phalangeal depth ratio.

In the past, many methods have been used to try to diagnose clubbing including water displacement, measurement of nail curvature using an unguisometer (which meas-

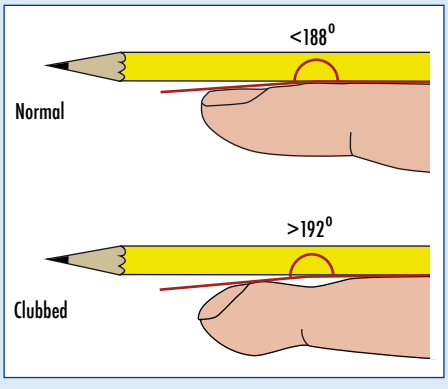
ures depth of indentation in mm; chord–arc distance), and measuring angle and ratios using plaster casts and shadow projections. However, the two most used methods are visual inspection and palpation of the cuticle for a 'spongy' nail bed. Aside from the obvious increase in connective tissue there is also a shiny, smooth cuticle on observation and a lilac hue of the nail fold has also been described resulting from vasodilatation (Myers and Farquhar, 2001).

The hyponychial angle is the angle between the nail base and its surrounding skin. It can be assessed by placing a pencil on the finger resting over the nail. In a normal person this angle is less than 188° and in clubbed fingers the angle exceeds 192° (Moreira et al, 2008) (*Figure 2*).

Fluctuance of the nail is increased sponginess of the soft tissue at the nail base causing the nail plate to develop a 'springy' feeling. If the skin proximal to the nail is compressed the nail moves away from the compression and returns once the pressure is removed giving the sensation of a floating nail bed (Mangione, 2000). In advanced cases the proximal edge of the nail may even be felt. The sign is elicited effectively by holding the sides of the finger with the examiner's thumb and middle finger and using the index finger to gently rock the nail using the nail bed as a fulcrum (Myers and Farquhar, 2001).

The phalangeal depth ratio is calculated by comparing the depth of the finger at the base of the nail (the distal phalangeal depth), and the interphalangeal joint (the interphalangeal depth) (*Figure 3*). The ratio in a normal individual is on average 0.895. As connective tissue accumulates, the pulp of the finger expands and reverses the ratio. So patients with clubbing have a ratio of 1 or more (Mangione, 2000).

Figure 2. Assessing the hyponychial angle.



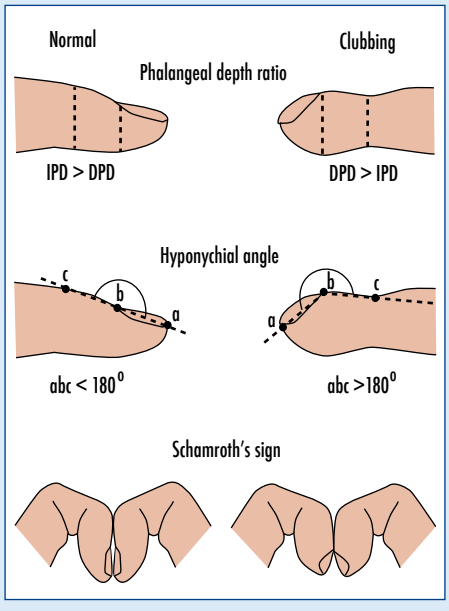
In 1976 Schamroth reported a clinical sign (eponymously called Schamroth's sign) that incorporates two of the diagnostic features of clubbing after noticing the sign on himself while suffering from recurrent episodes of endocarditis. Normally if the dorsal surfaces of similar fingers are juxtaposed a diamond-shaped window is seen between the two nailbeds. However, in clubbing the loss of the hyponychial angle obliterates the diamond window. This technique has become popular with physicians as it is quick and easy to do in a bedside examination (Mangione, 2000) (*Figure 3*).

Table 1 lists the different grades of clubbing.

Reliability of these methods

The accuracy of the techniques described above to detect clubbing has not been formally established but the literature indicates that interobserver agreement is only fair to moderate. Although impractical in most cases, if clubbing is suspected, using callipers at the bedside to elicit the phalangeal depth ratio may be the most reliable test as it has good sensitivity and specificity. A ratio greater than 1 was found in 85% of children with cystic fibrosis and in fewer than 5% of children with chronic asthma, a disease not commonly associated with clubbing of the fingers (Mangione, 2000). Furthermore, such measurements have been used to try and establish if the degree of clubbing is predictive of its aetiology. Myers and Farquhar (2001) found that while a normal depth ratio does not exclude lung cancer, an abnormal ratio implies an increased probability of underlying malignancy (likelihood ratio = 3.9, 95% confidence interval = 1.6–9.4). Pallarés-Sanmartin et al (2010) looked at the inter-observer validity and reliability of the Schamroth sign and found it had a sensitivity of 77–87% and a specificity of 90%. This led them to conclude that the technique is a reasonably accurate method for diagnosing clubbing and the most practical at the bedside.

Figure 3. Diagnostic features of clubbing. DPD = distal phalangeal depth; IPD = interphalangeal depth.



Causes

Clubbing is classified as being idiopathic or acquired. There are two forms of idiopathic clubbing. The hereditary form becomes apparent during childhood and persists lifelong, and is inherited in an autosomal recessive pattern (Tariq et al, 2009). The second form is associated with hypertrophic osteoarthropathy and is characterized by clubbing, skin changes and periostitis, hence its other name of pachydermoperiostosis (Peerbhoy et al, 2006).

Conditions associated with acquired clubbing are shown in *Table 2* – common causes seen in the PACES exam are highlighted in bold.

Investigations and management

As clubbing has such a wide differential it is important that a full and complete history and clinical examination is carried out, as that will focus investigations in most cases. It is important to note onset of clubbing, as a recent presentation of the sign will indicate a need for more intensive investigation. Specific management is then dictated by the underlying cause of the clubbing (Llewelyn et al, 2009).

Table 1. Grades of clubbing

Grade	Description
I	Fluctuation and softening of the nail bed
II	Loss of the hyponychial angle
III	Accentuated convexity of the nail
IV	Fingertip develops a clubbed appearance
V	Nail and surrounding skin develops a glossy change with longitudinal striations of the nail

Conclusions

Although clubbing can be a benign incidental finding on examination with no underlying pathology the possibility of sinister causes should prompt a thorough history and investigations. The sign can be readily observed at the bedside, simple techniques can confirm its presence, and prompt diagnosis and subsequent investigations could make all the difference in a patient's care. **BJHM**

Conflict of interest: Professor R Miller is Editor-in-Chief and Dr PJ Smith is Associate Editor of the British Journal of Hospital Medicine*, but neither has been involved in the peer review process for this article; Dr C Gibb: none.*

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Table 2. Conditions associated with acquired clubbing

System	Causes (prevalence)	Other clinical features
Respiratory	**Cystic fibrosis**	Young age, bowel obstruction recurrent chest infections
	Bronchiectasis	Dyspnoea, disabling cough, profuse green/yellow sputum
	Lung abscess	Cough, fever, night sweats
	Empyema	Systemically unwell, 'stony dull' on percussion
	Chronic mycobacterial or fungal infection	Cough, spiking fevers
	Pulmonary fibrosis (65%)	Chronic dry cough, coarse 'late inspiratory' bibasal crackles, dry cough, fine inspiratory crackles
	Pneumoconiosis	Dyspnoea, pleuritic pain
	Asbestosis	Dyspnoea, haemoptysis, cachexia
	Bronchial carcinoma (29%)	As above
	Mesothelioma	Chest pain
	Pleural fibroma	
Cardiovascular	**Cyanotic congenital heart disease**	Cyanosis, heart murmur
	Infective endocarditis	Fever, new or changing heart murmur, septic embolism
	Arterial graft sepsis	Fever, rigors
	Atrioventricular malformation	Left parasternal heave
	Arteriovenous fistula	Palpable thrill over fistula
	Atrial myxoma	Platypnoea, dizziness, palpitations
Gastrointestinal	**Inflammatory bowel disease (15–38%)**	Abdominal pain, change in bowel habit, weight loss
	Oesophageal carcinoma	Dysphagia and odynophagia
Hepatobiliary	**Cirrhosis (esp. primary biliary cirrhosis) (24%)**	Jaundice, fetor hepaticus, ascites
	Chronic active hepatitis (29%)	Weight loss, easy bruising and ascites
Endocrine	Thyroid acropachy (20%)	Swelling of whole finger or toe, ophthalmoplegia
Other	Thalassaemia	Anaemia
	Hodgkin's lymphoma	Night sweats, splenomegaly
	Metastatic osteogenic sarcoma	Pathological fractures, bone pain

Common causes seen in the PACES exam are highlighted in bold

KEY POINTS

- Clubbing has three diagnostic features: loss of the hyponychial angle, fluctuance of the nail and an abnormal phalangeal depth ratio.
- There is increased vascularity leading to hyperplasia of fibrous tissue and oedema causing thickening of the tissue in the finger pulp.
- The underlying aetiopathogenesis is still unclear.
- Clubbing can be diagnosed at the bedside. Inter-observer agreement is fair to moderate. Measuring the phalangeal depth ratio with callipers is the most accurate technique to confirm the diagnosis.