

# Evidence Summary: Lymphoedema: Objective assessment using tonometry

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## QUESTION

What is the best available evidence on tonometry to assess lymphoedema?

## SUMMARY

Tonometry assesses the resistance of tissue to pressure (that is, hardness)<sup>1</sup>. Because of the difficulties in obtaining precise and consistent measurements<sup>2</sup>, and being limited to measuring the resistance of oedematous tissue to pressure<sup>1</sup>, tonometry should not be used as the sole objective assessment of lymphoedema (Level 3.e evidence).

## BACKGROUND

Lymphoedema is a form of chronic, progressive oedema in which there is significant, persistent swelling of a limb or other body region due to excess and abnormal accumulation of protein-rich fluid in body tissues. This fluid includes a range of inflammatory mediators and adipogenic factors<sup>3-7</sup>. The lymphatic system is unable to manage the volume of accumulated fluid and its contents<sup>6</sup>.

Lymphoedema occurs due to primary, secondary or mixed causes. Primary causes are described as congenital (for example, an inherited disorder such as Milroy's disease), praecox (onset at puberty, for example, Meig's disease) or tarda (sudden onset, no apparent cause)<sup>8-10</sup>. Secondary causes arise from direct damage or trauma to the lymphatic system such as injury surgery or radiotherapy (usually related to treatment of breast cancer), or parasitic invasion<sup>9-11</sup>. Lymphatic filariasis (also called elephantitis) is a cause of secondary lymphoedema in endemic areas primarily in Africa and Asia. Lymphatic filariasis is a parasitic (roundworm) infection that is spread by mosquitoes and causes damage to the lymphatic system that may result in lymphoedema. Infection generally occurs in childhood. Management focuses on large-scale treatment programs to reduce disease spread<sup>7,12</sup>. Mixed lymphoedema describes lymphoedema arising from decompensation or failure of the lymphatic system associated with other diseases or conditions, including but not limited to obesity, immobility, venous disease or lipoedema<sup>9,10,13</sup>.

Without management, lymphoedema may lead to:<sup>6,14</sup>

- progressive swelling
- superficial tissue changes — increasing adiposity and fibrosis
- physical and functional limitations
- increased risk of chronic infection
- lymphorrhoea (leaking of lymph fluid)
- pain and discomfort
- reduced ability to undertake activities of daily living (ADLs).

Comprehensive assessment of lymphoedema includes objective measures of volume/size, and subjective assessment of signs and symptoms, including their impact on the patient<sup>15</sup>. In patients with mixed lymphoedema, it is also important to assess factors associated with the underlying disease or condition (not addressed in this evidence summary).

This evidence summary presents evidence related to the reliability and validity of one objective measurement used to assess lymphoedema: tonometry.

Tonometry measures volume of interstitial fluid and tissue fibrosis. Tonometry is a technique to assess the "hardness" of tissue through measuring its resistance to pressure<sup>1</sup>.

## CLINICAL BOTTOM LINE

### Performing tonometry

- A tonometer is positioned perpendicular to the skin and the reference plate is lowered until it touches the skin<sup>2</sup>.
- Depth of descent is recorded and tissue resistance is measured at various anatomical locations. Locations used in the literature include:
  - the midpoint of the forearm<sup>1,2</sup>
  - midpoint of dorsal surface of proximal interphalangeal joint<sup>2</sup>
  - distal interphalangeal joint of middle finger<sup>2</sup>
  - midpoint of the clavicle<sup>1</sup>
  - supraspinatus fossa<sup>1</sup>.
- For all measures of limb size and/or volume, comparison should be made with:<sup>15,16</sup>
  - a pre-condition measurement of the affected limb (where available) to determine change in tissue resistance;
  - the unaffected limb to determine difference in tissue resistance; and
  - the affected limb over time to objectively assess the effectiveness of the management plan.

### Validity and reliability of tonometry

- One validation study conducted with patients with breast cancer-associated lymphoedema (n=17) reported that intra-rater reliability (2 measurements) ranged from 0.66 to 0.879 (p<0.05) for measurements made at the forearm, hand and finger. Inter-rater reliability (2 raters) ranged from 0.688 to 0.714 (p<0.05). Standard error of measurement was between 4.3% and 17.8%, with error being greatest for the finger measurement<sup>2</sup> (Level 3.e evidence).
- One observational study compared tissue tonometry measurements in patients with unilateral lower limb filarial-associated oedema Grade II (n=34) and Grade

III (n=29) and health volunteers (n=26). Tonometry was conducted at three fixed anatomical locations on the leg using three weights (70, 140 and 210 grams). Mean compressibility was significantly less for the oedematous leg at every point and with each weight level, when compared with the non-oedematous leg and with healthy volunteers. Additionally, the findings indicated that oedematous changes in filarial patients commence in the foot and progress up the leg<sup>17</sup> (Level 3.c evidence).

#### Limitations of tonometry

- Difficulty in obtaining consistent measurements<sup>2</sup>, because the device must be steadied for the same length of time before taking a reading for every measurement<sup>1</sup>.
- Greater measurement variation and less precision than arm circumference or volumetry measurements<sup>2</sup>.

## CHARACTERISTICS OF THE EVIDENCE

This evidence summary is based on a structured literature and database search combining search terms that describe lymphoedema and assessment. The evidence in this summary comes from:

- Systematic reviews of studies of various design<sup>1,4</sup> (Level 1.b evidence).
- Cohort studies with control groups<sup>16,17</sup> (Level 3.c evidence).
- Observational studies with no control group<sup>2,11,15</sup> (Level 3.e evidence).
- Case series report<sup>13</sup> (Level 4.c evidence).
- Expert consensus<sup>7,9</sup> (Level 5.b evidence).
- Expert opinion<sup>3,5,6,8,10,12,14</sup> (Level 5.c evidence).

## BEST PRACTICE RECOMMENDATIONS

- Tonometry should not be used as the sole objective assessment of lymphoedema. (Grade A).

#### Related evidence summaries

- JBI 10912 Identification of people at risk of venous leg ulcers
- JBI 11559 Lymphoedema: classification
- JBI 11564 Lymphoedema: bioimpedance assessment
- JBI 11562 Lymphoedema: perometry assessment
- JBI 11560 Lymphoedema: subjective assessment
- JBI 11871 Lymphoedema: volumetry assessment

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