Clinical Task Instruction

SKILL SHARED TASK

S-FC03: Calculate an Ankle Brachial Pressure Index and Toe Brachial Pressure Index

Scope and objectives of clinical task

This CTI will enable the health professional to:

- accurately measure and calculate an Ankle Brachial Pressure Index (ABI) and Toe Brachial Pressure Index (TBI) to support risk categorisation findings if indicated by the findings from the implementation of CTI S-FC01: Assess the risk of foot complications and CTI S-FC02: Doppler ultrasound of the foot and ankle.

Note: the local health service will determine the scope to implement ABI, TBI or both. This will be influenced by local procedures, equipment access and other factors. The scope of an individual health professional should be recorded in the Performance Criteria Checklist.

VERSION CONTROL

Version:	1.0		
Endorsed: (Professional)	Queensland Hospital and Health Service Podiatry Steering Committee	Date approved:	19/3/2019
Approved: (Operational)	Chief Allied Health Officer, Allied Health Professions' Office of Queensland	Date approved:	9/4/2019
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Acknowledgements:	Mackay Hospital and Health Service, Metro North Hospital and Health Service		

The CTI reflects best practice and agreed process for conduct of the task at the time of approval and should not be altered. Feedback, including proposed amendments to this published document, should be directed to AHPOQ at: allied_health_advisory@health.qld.gov.au.

This CTI should be used under a shill sharing framework implemented at the work unit level. The framework is available at: https://www.health.qld.gov.au/ahwac/html/calderdale-framework.asp

Please check https://www.health.qld.gov.au/ahwac/html/clintaskinstructions.asp for the latest version of this CTI.

Requisite training, knowledge, skills and experience

Training

- Mandatory training requirements relevant to Queensland Health/HHS clinical roles are assumed knowledge for this CTI including infection control, hand hygiene and patient manual handling.
- Competence in or demonstrated professional equivalence in:
  - CTI S-FC01: Assess the risk of foot complications
  - CTI S-FC02: Doppler ultrasound of the foot and ankle.

Clinical knowledge

To deliver this clinical task a health professional is **required** to possess the following theoretical knowledge:

- the purpose of completing an ABI and TBI measurement including indications, contraindications, precautions and limitations
- sphygmomanometer and Doppler ultrasound unit features and the application process including bony landmarks for probe placement and orientation of the ankle and foot, client position and skin preparation
- basic foot anatomy to the extent required to undertake this CTI including the names and locations of bony landmarks and areas of the foot and lower leg and the location of pedal pulses
- basic vascular anatomy of the foot, leg and arm
- recognition of common wave forms and technique errors for an ABI and TBI and adaptations to the procedure to improve the accuracy of findings.

The knowledge requirements will be met by the following activities:

- review of the ‘Learning resource’
- receive instruction from the lead health professional in the training phase
- read and discuss the following references/resources with the lead health professional at the commencement of the training phase:
  - local referral pathways for vascular review.

Skills or experience

The following skills or experience are not specifically identified in the task procedure but support the safe and effective performance of the task or the efficiency of the training process and are:

- **required** by a health professional in order to deliver this task:
  - competent use of a Doppler ultrasound machine to measure arterial blood flow to the ankle and foot e.g. competence in CTI S-FC02: Doppler ultrasound of the foot and ankle
- **relevant but not mandatory** for a health professional to possess in order to deliver this task:
  - nil.

Indications and limitations for use of a skill shared task

The skill share-trained health professional shall use their independent clinical judgement to determine the situations in which he/she delivers this clinical task. The following recommended indications and limitations are provided as a guide to the use of the CTI but the health professional is responsible for applying clinical reasoning and understanding of the potential risks and benefits of providing the task in each clinical situation.

Indications

- The client has a lower limb wound or ulcer
- The client has a non-palpable or diminished pulse

  AND

For an ABI

  – The client presents with monophasic or biphasic wave patterns on ankle/foot ultrasound

  OR

For a TBI

  – The client presents with absent wave patterns on ankle/foot ultrasound

Limitations

- Limitations listed in CTI S-FC01 and CTI S-FC02 apply.
- The client has a known or suspected deep venous thrombosis (DVT) or a history of DVT. Performing an ABI could lead to dislodgement of the thrombosis. Conduct a TBI instead of an ABI providing that the skill share-trained health professional has been trained and assessed as competent in performing a TBI. If TBI is not in the scope for the skill share-trained health professional implement referral pathways for TBI assessment.
- The client has a known history of diabetic peripheral neuropathy or a wound around the ankle. Conduct a TBI instead of an ABI providing that the skill share-trained health professional has been trained and assessed as competent in performing a TBI. If TBI is not in the scope for the skill share-trained health professional implement referral pathways for TBI measurement.
- The client has known severe ischaemia, cellulitis or recent surgery/trauma to the lower limb e.g. bypass donor grafting site or ankle fracture with/without stabilisation. Conduct a TBI instead of an ABI providing that compression of the toe is not directly affected and the skill share-trained health professional has been trained and assessed as competent in performing a TBI. If TBI is not in the scope for the skill share-trained health professional implement referral pathways for TBI assessment.
- The client reports severe pain in the lower legs/feet which the placement of pressure from the cuff would exacerbate e.g. neuropathic pain, rheumatoid arthritis or osteoarthritis. The client may require further investigation or imaging e.g. duplex ultrasound. Implement local referral pathways for further assessment and investigation.
- The client has a dialysis fistula or history of lymph node/vessel removal e.g. axillary clearance for breast cancer. The use of a blood pressure cuff on the affected side is contraindicated. Use measurements from the contralateral/unaffected limb in calculations.
- The client is requiring an ABI as part of a compression garment prescription and the prescription of pressure garments is not within the scope of the skill share-trained health professional.
- The client has had a recent revascularisation procedure.

Safety and quality

Client

The skill share-trained health professional shall identify and monitor the following risks and precautions that are specifically relevant to this clinical task:

- generally, the cuff is placed on the first toe. Where the first toe is not available e.g. a pre-existing condition, including amputation, deformity, pain or preference, the second or third toe can be used. Where this is the case this should be noted as part of recording the results.
- Clients who are tense may contract their muscles which will restrict the underlying vessels, making the pulse more difficult to find due to their smaller cross section. Tension can be reduced by ensuring that the client is positioned comfortably, understands the procedure and has the opportunity to ask questions. Clients who are tense should be encouraged to relax their muscles.
- If the client is wearing tight or close-fitting pants, trousers or shirt sleeves, determine if they need to be removed. Generally, pants and sleeves can be rolled up to allow inspection of the ankle or elbow, however if clothing is firm or tight above the ankle or elbow, this will restrict blood flow and make examination difficult. If clothing removal is required, ensure modesty is maintained e.g. a gown to wear or a towel to drape across the lap.
- If the client is wearing a compression garment, determine the reason. Check the “Limitations” section. If suitable for ABI and TBI assessment, remove the garment. After the examination assist the client to don the garment.
- Clients may not be able to have bilateral brachial measurements due to a missing limb (amputation or congenital), pre-existing condition (lymphoedema, pain) or access issue (drips, drains, intravenous lines). Where measurements are only available for one arm, conduct and record measurements from the limb available. Record the side on which measurements were taken and the reason.
- If the client presents with wounds or ulcers, remove any bulky dressings from the area and cover with clear film (cling film) prior to placing equipment on the site. This is to reduce the risk of cross infection.
- If the client has medical or surgical restrictions, these must be adhered to during the assessment. These may include positioning restrictions or wearing splints that cannot be removed. If access to the ankle is precluded, consider performing a TBI instead. If only one limb is available, use measurements from the contralateral/ unaffected limb in calculations and arrange for re-investigation of the affected side when restrictions are removed. If the foot has a temperature discrepancy, slow or poor capillary refill or the colour of the toes appear pale, dusky or reddened compared to the unaffected limb, liaise with the medical team for vascular review.
- If the client is unable to lie flat due to breathlessness, low back pain or other causes, elevate the legs to the level of the heart to normalise the hydrostatic pressure. Adhere to any medical or surgical restrictions or limitations e.g. hip precautions. Record the variation in position as part of documenting results.
- The absolute ankle or toe pressure assists with predicting wounding healing or outcome. The calculation of an ABI or TBI assists in the inclusion or exclusion of peripheral artery disease. Clients with hypertension (as measured at the arm) should have measurements repeated for accuracy. The purpose of recording measurements and indices should be determined prior to commencing task.

Equipment, aids and appliance

- The sphygmomanometer cuff can be applied upside down to stop the tube getting covered with gel during the examination. Some cuffs have tubing that allows repositioning.
- Inappropriate sphygmomanometer cuff sizing and placement can lead to measurement error. The bladder length should be approximately 80% of the client's arm circumference[1]. The midline of the cuff bladder should be positioned, above the elbow, on the humerus, near the brachial artery. The cuff should fit comfortably prior to inflation. If the cuff velcro fastening fails during inflation check that the cuff size is correct and consider replacing with a longer, wider cuff or shorter, smaller cuff to improve fit.
- When inflating a sphygmomanometer cuff, monitoring of pressure is required to prevent harm to the client. Over inflating a cuff can dislodge plaques in the blood vessels. Inflation of 20mmHg beyond the level of the pulse disappearing is not recommended. When conducting an ABI, use of a stethoscope should be avoided as it will alter the accuracy of the index reading. If it is necessary to re-inflate the cuff due to the loss of sound not being identified, ensure the cuff is fully deflated prior to re-inflation occurring. If needing to retest on the same toe for a TBI to avoid reactive hyperaemia, wait a minimum of three minutes prior to re-inflating the cuff.
- As this assessment includes the use of electrical equipment, all equipment should be examined to ensure it is in good working order e.g. cords are not frayed, switches are working properly and if in a Queensland Health facility, test and tag is in situ and current.
- Ultrasound probes are designed to be used with ultrasound gel. The use of KY jelly or other lubricants can damage the crystals in the probe head and should not be used. If ultrasound gel is not available, cease the task and liaise with a health professional with expertise in the task.

Environment

- Quiet and comfortable environment to allow the client to relax in a supine position prior to testing as part of the 10-15 minute preparation period.

Performance of Clinical Task

1. Preparation

- Collect the required equipment including:
  - Doppler ultrasound with the required probe e.g. 8 MHz, or for large or oedematous limbs 5 MHz, photoplethysmography (PPG) probe for performing TBI
  - ultrasound gel
  - sphygmomanometer and large limb cuff for ABI and toe/digit cuff for TBI
  - clean gloves
  - cling film or vapour-permeable film dressing or equivalent (if required)
  - calculator or ABI and TBI graphs
  - pen and local recording template.

[1] Smith L (2005). New AHA Recommendations for blood pressure measurement. American Family Physician 72(7): 1391-1398. Available at: https://www.aafp.org/afp/2005/1001/p1391.html#afp20051001p1391-t3

2. Introduce task and seek consent

- The health professional checks three forms of client identification: full name, date of birth **plus one** of the following: hospital UR number, Medicare number, or address.
- The health professional introduces the task and seeks informed consent according to the Queensland Health Guide to Informed Decision-making in Health Care, 2nd edition (2017).

3. Positioning

- The client's position during the task should be:
  - supine on the bed/plinth or couch with leg supported. The client should be comfortable and relaxed.
- The health professional's position during the task should be:
  - in a position to be able to easily access the client's ankle and operate the ultrasound machine.

4. Task procedure

- The task comprises the following steps:

1. Determine if an ABI or TBI will be measured. Confirm which limbs will be measured by checking the client's history and the 'Limitations' section above.
2. Ask the client to expose the identified upper arms, feet and ankles. See the 'Safety and quality' section.
3. Place the client in a supine position for a minimum of 10-15 minutes to obtain a resting pressure and reduce any hydrostatic pressure inaccuracies.
4. **For measuring the ABI**

   Measure the arm pressure on both sides (see 'Limitations', 'Safety and quality') by:

   i. placing an appropriate sized cuff on the arm, just above the elbow
   ii. palpate the brachial pulse and locate with the Doppler probe
   iii. complete steps 5-7
   iv. record the measurement
   v. Repeat steps i-iv for the other arm.

   Measure the ankle pressure for each leg by:

   i. placing an appropriately sized cuff on the ankle 1cm above the lateral malleolus
   ii. palpate the posterior tibial pulse and locate with the Doppler probe
   iii. complete steps 5-7
   iv. With the ankle cuff in situ, palpate the dorsalis pedis pulse on the same leg and locate with the Doppler probe
   v. complete steps 5-7
   vi. determine the pressure reading of the highest ankle pulse available for use in calculating the ABI for that leg.

   For measuring the TBI

   i. Place an appropriate sized cuff on the base of the first toe. See the 'Safety and quality' section.
   ii. Affix the PPG probe on the apex of the toe using micropore or similar tape.
   iii. Complete steps 5-7.

5. Maintaining the probe position, inflate the sphygmomanometer cuff until the wave form (or sound) of the pulse disappears and then inflate the cuff a further 10-20mmHg.
6. Slowly and gradually deflate the cuff observing the pressure gauge and record the pressure at which the sound waves return.
7. Remove and clean the cuff. Wipe any gel off the client's skin.
8. Calculate the ABI or TBI. See 'Learning resource'.

5. Monitoring performance and tolerance during the task

- Common errors and compensation strategies to be monitored and corrected during the task include:
  - if the client has absent pulses, place the probe in the general area of the anatomical reference and expand out slowly to account for any anatomical anomalies. If the audible sound of the pulse is not heard, use a slow gentle circular movement in a zig-zag pattern.
  - if the signal quality is poor, maintain the probe head in contact with the skin and move the base of the probe in an arc to re-orientate the probe to improve the sound quality.
  - signal quality is affected by air. The probe head should be completely immersed in the gel when placed on the client's skin. If gaps are present, add more gel.
  - if the client has difficulty removing clothing above the elbow, or the client's body shape or arm size makes application of the sphygmomanometer cuff difficult, place the cuff below the elbow. The radial pulse will be located on the thumb side of the wrist. Note the position variance when documenting the reading.
  - if signals are absent at all sites, check that the probe is suitable (see the 'Preparation' section above) and the machine settings e.g. power on, probe securely attached.
  - if the examination gets interrupted, deflate the cuff as prolonged inflation will alter the pressure reading.

    For the ABI the Doppler probe needs to be steady during cuff deflation. Whilst inflating the cuff observe the probe and listen for the sound wave to disappear. Once the sound waves have disappeared, squeeze the cuff pump 1-2 times to achieve the required further 10-20mmHg inflation. Recording accuracy is affected by too fast and too slow pressure release, deflation rate should be ~10mmHg/second. Observe the sphygmomanometer dial for slow, steady deflation. If no sound is apparent, recommence the task being mindful of probe placement throughout.
  - **For the TBI** the probe is sensitive to movement. The skill share-trained health professional should sit in a position to view both the toe and the wave form monitor in the same visual field. If movement of the toe is observed, cease deflation until the client is still and the wave form is normalised. Recommence deflation and continue to observe.
- Monitor for adverse reactions and implement appropriate mitigation strategies as outlined in the 'Safety and quality' section above.

6. Document

- Document the outcomes of the task as part of the skill share-trained health professional's entry in the relevant clinical record, consistent with documentation standards and local procedures. For this task:
  - measurement at the arm, ankle and/or toe mmHg
  - left or right
  - index (ankle and/or toe)

- The skill shared task should be identified in the documentation as ‘delivered by skill share-trained (*insert profession*) implementing S-FC03: Calculate an Ankle Brachial Pressure Index and Toe Brachial Pressure Index’ or similar wording.

References and supporting documents

- Queensland Health (2017). Guide to Informed Decision-making in Health Care (2nd edition). https://www.health.qld.gov.au/__data/assets/pdf_file/0019/143074/ic-guide.pdf

Assessment: Performance Criteria Checklist

S-FC03: Calculate an Ankle Brachial Pressure Index and Toe Brachial Pressure Index

Name: **Position:** **Work Unit:**

Performance Criteria	Knowledge acquired	Supervised task practice	Competency assessment
	Date and initials of supervising AHP	Date and initials of supervising AHP	Date and initials of supervising AHP
Demonstrates knowledge of fundamental concepts required to undertake the task through observed performance and the clinical reasoning record.			
Identifies indications and safety considerations for the task and makes appropriate decisions to implement the task, including any risk mitigation strategies, in accordance with the clinical reasoning record.			
Completes preparation for the task including collecting a probe, sphygmomanometer cuff, gloves, gel, calculator or graphs, pen and recording template.			
Describes the task and seeks informed consent.			
Prepares the environment and positions self and client appropriately to ensure safety and effectiveness of the task, including reflecting on risks and improvements in the clinical reasoning record where relevant.			
Delivers the task effectively and safely as per the CTI procedure, in accordance with the Learning resource. a) Clearly explains and demonstrates the task, checking the client's understanding. b) Determines if an ABI or TBI will be measured, including the client's suitability and size of sphygmomanometer cuff. c) Suitably accesses the client's upper limb, feet and ankles by removing clothing and maintaining modesty. d) Ensures the client rests in a supine position for a minimum of 10-15 minutes prior to testing. e) Measures the arm, ankle and/or toe pressure by accurately locating the pulse with the Doppler probe, using suitable cuff inflation/deflation and observing the wave form. f) Correctly removes the probe, cuff and gel from the client. g) Correctly calculates the ABI and/or TBI. h) During the task, maintains a safe clinical environment and manages risks appropriately.			
Monitors for performance errors and provides appropriate correction, feedback and/or adapts the			

task to improve effectiveness, in accordance with the clinical reasoning record.			
Documents in the clinical notes including a reference to the task being delivered by the skill share-trained health professional and the CTI used.			
If relevant, incorporates outcomes from the task into an intervention plan e.g. plan for task progression, interprets findings in relation to care planning, in accordance with the clinical reasoning record.			
Demonstrates appropriate clinical reasoning throughout the task, in accordance with the Learning resource.			

Notes on the scope of the competency of the health professional

The health professional has been trained and assessed as competent to deliver:

□ Ankle Brachial Pressure Index (ABI)

□ Toe Brachial Pressure Index (TBI)

Comments:

Record of assessment competence:

Assessor name:	Assessor position:	Competence achieved: / /

Scheduled review:

Review date: / /

S-FC03: Calculate an Ankle Brachial Pressure Index and Toe Brachial Pressure Index

Clinical Reasoning Record

The clinical reasoning record can be used:

- as a training resource, to be completed after each application of the skill shared task (or potential use of the task) in the training period and discussed in the supervision meeting
- after training is completed for the purposes of periodic audit of competence
- after training is completed in the event of an adverse or sub-optimal outcome from the delivery of the clinical task, to aid reflection and performance review by the lead practitioner.
- The clinical reasoning record should be retained with the clinician's records of training and not be included in the client's clinical documentation.

Date skill shared task delivered: _____

1. Setting and context

- insert concise point/s outlining the setting and situation in which the task was performed, and their impact on the task

2. Client

Presenting condition and history relevant to task

- insert concise point/s on the client's presentation in relation to the task e.g. presenting condition, relevant past history, relevant assessment findings

General care plan

- insert concise point/s on the client's general and profession-specific/allied health care plan e.g. acute inpatient, discharge planned in 2/7

Functional considerations

- insert concise point/s of relevance to the task e.g. current functional status, functional needs in home environment or functional goals. If not relevant to task - omit.

Environmental considerations

- insert concise point/s of relevance to the task e.g. environment set-up/preparation for task, equipment available at home and home environment. If not relevant to task - omit.

Social considerations

- insert concise point/s of relevance to the task e.g. carer considerations, other supports, client's role within family, transport or financial issues impacting care plan. If not relevant to task - omit.

Other considerations

- insert concise point/s of relevance to the task not previously covered. If none - omit.

3. Task indications and precautions considered

Indications and precautions considered

- insert concise point/s on the indications present for the task, and any risks or precautions, and the decision taken to implement/not implement the task including risk management strategies.

4. Outcomes of task

- insert concise point/s on the outcomes of the task including difficulties encountered, unanticipated responses

5. Plan

- insert concise point/s on the plan for further use of the task with this client including progression plan (if relevant)

6. Overall reflection

- insert concise point/s on learnings from the use of the task including indications for further learning or discussion with the lead practitioner

Skill share-trained health professional	**Lead health professional (trainer)**
Name:	Name:
Position:	Position:
Date this case was discussed in supervision:	***/ /***
Outcome of supervision discussion:	e.g. further training, progress to final competency assessment

Calculate and Ankle Brachial Pressure Index and Toe Brachial Pressure Index: Learning resource

Required reading

Ankle Brachial Pressure Index (API)

- Scottish Intercollegiate Guidelines Network (2006). 89 Diagnosis and management of peripheral arterial disease. A national clinical guideline. Annex 1: A recommended method for measurement of ankle brachial pressure index. Available at: https://www.nhstaysideadtc.scot.nhs.uk/wound%20Formulary/Pdf%20docs/Sign%2089%20PAD.pdf
- Smith and Nephew (2013). ABPI: Essential diagnosis prior to compression. Available at: http://www.smith-nephew.com/documents/anz/sn11162%20-%20vlu%20abpi%20vascular%20assessment.pdf
- Stanford Medicine (2018). Measuring and Understanding the Ankle Brachial Index (ABI). Available at: http://stanfordmedicine25.stanford.edu/the25/ankle.html
- World Wide Wounds (2001). Doppler assessment and ABPI: Interpretation in the management of leg ulceration. Available at: http://www.worldwidewounds.com/2001/march/Vowden/Doppler-assessment-and-ABPI.html

Toe Brachial Pressure Index (TPI)

- Vascular Medicine Angiologist.com (2010-2017). Toe brachial index. Available at: http://www.angiologist.com/vascular-laboratory/toe-brachial-index/
- Huntleigh Healthcare Limited (2002). Toe Brachial Pressure Index Guide. Available at: http://www.arjohuntleigh.net/diagnostics/Admin/files/20081027141808.pdf

Required viewing

- Huntleigh Healthcare (2017). Toe Pressure Index (TBI) with Dopplex DMX. Available at: https://www.youtube.com/watch?v=6ouTyqtFOAo
- StMichaelsHospital (2017). How to perform an ankle brachial index. Available at: https://www.youtube.com/watch?v=0_0VILSTAAE
- Time of Care: Online Medicine Notebook (n.d.). Ankle Brachial Index, Cardiology. Available at: https://www.timeofcare.com/ankle-brachial-index/

Optional reading

- Clinical practice guideline: Executive Summary 2016 AHA/ACC Guideline on the management of patients with lower extremity peripheral artery disease: Executive Summary Journal of American College of Cardiology
- Queensland Government (2015). Metro South Hospital and Health Service. Ankle Brachial Index (ABI): Self-Directed Learning Package and Competency. V2. Available at: http://paweb.sth.health.qld.gov.au/wards/1C/documents/abi-learning-package.pdf

Figure 1 **An example of a local clinical support tool for arterial evaluation of the lower limb**