SAGITTAL DIAMETER

1. Background and Rationale

Sagittal diameter, also known as abdominal thickness, is the distance between the abdomen and back as measured by an abdominal caliper. Sagittal diameter has been used to estimate abdominal fat, although it cannot be used to distinguish between subcutaneous and visceral fat.[1-5] However, it is a quick and easy measure which can be employed to answer basic research questions important to Health ABC. First, is abdominal fat and/or changes in abdominal fat estimated by sagittal diameter related to risk of weight-related disease/disability or mortality? Second, can clinically useful equations estimating abdominal fat from sagittal diameter (and other anthropometric measurements) be developed and validated by comparison with CT? Furthermore, can these equations be used to measure change in abdominal fat? Sagittal diameter is measured in centimeters using the Holtain-Kahn Abdominal caliper.

2. Equipment and Supplies

- Holtain-Kahn abdominal caliper
- Cosmetic Pencil
- Washcloth
- A flexible inelastic fiberglass tape (about 0.7 cm wide) that is marked in centimeters alone on one side. (Confusion may arise if the tape is marked in centimeters and inches on the same side).
- Plastic container for holding warm water to keep caliper warm

2.1 Equipment Maintenance

Check the Holtain-Kahn abdominal caliper daily. A small Allen wrench (L-shaped hexagonal rod) is supplied with the caliper. When necessary, use this wrench to re-tighten the screw that fastens the lower, fixed arm to the vertical shaft of the caliper. Also, occasionally it may be necessary to tighten the small, nylon screws on the sliding cuff.

3. Safety Issues and Exclusions

The measurement of sagittal diameter poses no safety concerns or reasons for exclusion.

4. Participant and Exam Room Preparation

The caliper should be kept in a warm water bath so that the the blade temperature will be more comfortable for the participant.

The measurement will be obtained with the participant wearing the clinic gown. Participants will be instructed prior to the visit not to wear restricting or compressing undergarments, such as girdles or panty hose, which could interfere with the measurement. If necessary, the participants underwear will have to be adjusted slightly to allow access to the iliac crests and abdomen.

Participants should be encouraged to empty bladder and bowels prior to the measurement.

> Script: "The measurement that we are about to take is more accurate if you use the bathroom before we measure you. If you need to use the bathroom it is down the hall."

Sagittal diameter can be assessed along with other supine measurements, including DXA scans, ankle-arm blood pressure, etc.

5. Detailed Measurement Procedures

5.1 Administration

1) Ask the participant to lie on the exam table.

2) Ask the participant to bend their knees. If necessary, readjust the participant's feet so that the knees are flexed to 45. The participant's feet should be resting flat on the table.

3) Ask the participant to lower their trousers a little bit. Adjust clinic garments farther to allow access to iliac crests and abdomen if necessary.

4) Ask the participant to place their hands comfortably on the upper part of the chest.

5) Palpate the right and left iliac crests and mark each with a cosmetic pencil.

Place the nonelastic, nonmetallic tape measure over the abdomen without compressing the skin, measuring from one iliac crest mark to the other; with a cosmetic pencil, make a mark on the front (anterior) abdomen that is midway between the left and right iliac crests (see figure below).

6) Slide the caliper's upper arm to its fullest height.

Ask the participant to raise their hips briefly and insert the caliper's lower arm under the small of the back. If participant cannot lift hips, have them roll gently to one side, keeping one hand on participant to be sure they do not roll too far, place caliper in position, then have participant roll back onto the lower arm of the caliper.

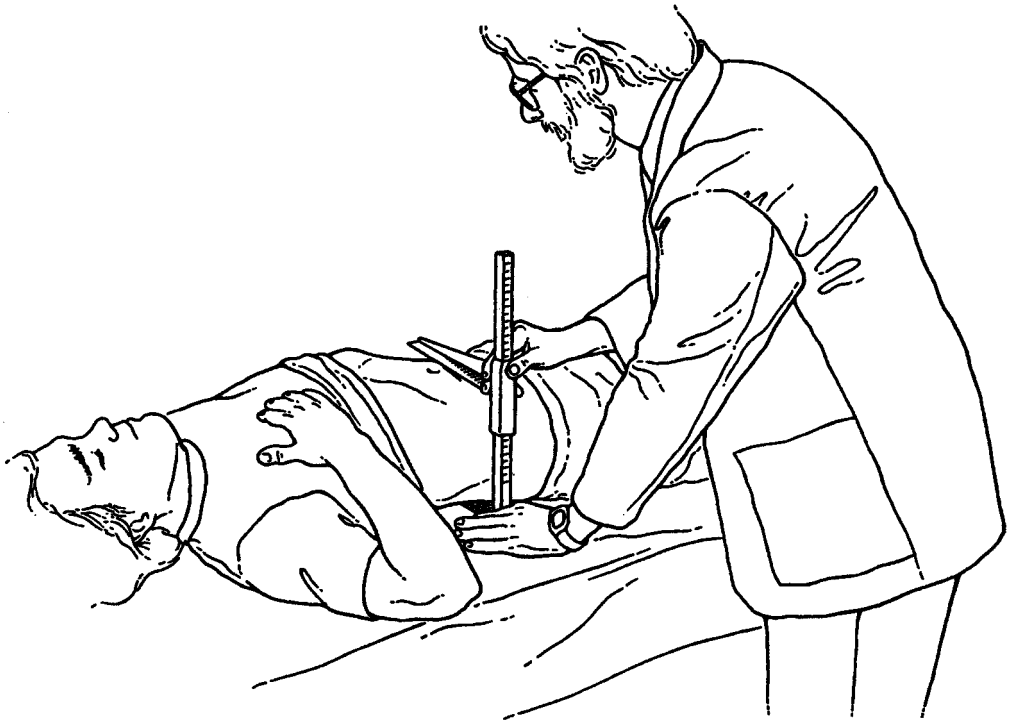
Check that the lower blade of the caliper is in contact with the participant's lower back by a) asking the participant if they can feel the caliper, and b) gently lifting up on the caliper to ensure that there is no space between the caliper blade and the lower back. If a gap is present, repeat positioning, placing a folded washcloth under the lower arm of the caliper.

7) Once the caliper's lower arm is appropriately situated, lower the upper arm so that it is about 2 centimeters above the abdomen with the left edge aligned with the mid-abdominal mark but not touching the abdomen. Check the bubble in the spirit level to be sure the caliper's shaft is vertical; if it is not, adjust the caliper's location accordingly. If caliper is not in the proper position, repeat the previous step, adjusting the position of the caliper under the back. Do not try to make major adjustments to the caliper's positioning by waggling it back and forth while the participant is lying on the lower arm.

8) Instruct participant to breathe naturally.

Promptly slide the caliper's upper arm downward letting it rest on the abdomen. (Do not compress the abdomen.) Let the caliper rest on the abdomen during several

breathing cycles and check the bubble in the spirit level to confirm vertical orientation. Take the measurement when the diaphragm is relaxed and the caliper blade is at the lowest point. (See figure below.)



Hold the vertical arm still and read the diameter on the centimeter scale to the nearest 0.1 centimeter. To obtain the measurement, it is necessary to count the number of ticks (tenths of cm) down from the nearest (higher) centimeter and then subtract that from the nearest higher centimeter. It may be easier for the examiner to read the number while sitting if measurement is made on a low table such as the QDR.

9) Raise the sliding arm to its fullest height and repeat the measurement. If the difference between the measurements is > 0.5 cm, a third and fourth measurement should be obtained. Record all the measurements. The computed value will be the mean of the two or four recorded values.

Script: "Please lie on the table. Now bend your knees. I am going to help position you so that I can measure the distance between your back and your stomach. Please lower your trousers a little bit. Place your arms on your chest like this (demonstrate)."

"Would you please lift your hips?"

"Just breathe naturally."

6. Procedures for Performing the Measurement at Home

To be addressed.

7. Alert Values/Follow-up/Reporting to Participants

If they ask, participants will be notified of the measurement results as it is being done.

8. Quality Assurance

8.1 Training Requirements

No special qualifications or experience are required to perform this assessment. Training should include:

- Read and study manual
- Attend Health ABC training session on techniques (or observe administration by experienced examiner)
- Practice on volunteers with a special emphasis on obese participants (Goal: differences between repeat measurements ≤ 1 cm)
- Compare measurements with those made by experienced colleagues (Goal: keep differences in any measurement ≤ 1 cm)
- Discuss problems and questions with local expert or QC officer

8.2 Certification Requirements

- Complete training requirements
- Conduct exam on 2 volunteers:
  - According to protocol, as demonstrated by completed QC checklist
  - Differences between repeat measurements ≤ 1 cm
  - Differences between trainee's and QC Officer's measurements should be ≤ 1 cm.

8.3 Quality Assurance Checklist

☐ Checks screws on caliper; tightens if necessary
☐ Encourages patient to empty bladder and bowels
☐ Positions participant correctly in a supine position with feet flat, knees flexed at 45 degrees, hands on chest
☐ Adjusts clinic garments to allow access to iliac crests and abdomen

- ☐ Palpates and marks both the left and right iliac crests
- ☐ Using tape measure, locates point on abdomen that is midway between right and left iliac crests
- ☐ Tape measure does not compress abdominal skin
- ☐ Marks midway point on abdomen with cosmetic pencil
- ☐ Slides caliper arm to its fullest height
- ☐ Has participant raise hips slightly (rolling technique used if necessary)
- ☐ Inserts caliper's lower arm under small of back
- ☐ Examiner checks that the caliper's lower arm is in contact with the participant's lower back both by questioning the participant and/or by feel
- ☐ If space between caliper and lower back exists, repeats positioning inserting washcloth
- ☐ Lowers caliper arm to within about 2 cm of abdomen mark and checks to be sure caliper is in proper position (spirit level is centered and left edge of caliper arm is aligned with abdominal mark)
- ☐ Instructs participant to breathe naturally
- ☐ Promptly slides caliper down to abdomen while participant is still at rest
- ☐ Caliper arm rests on but does not compress abdomen
- ☐ Checks spirit level to confirm vertical orientation
- ☐ Records distance to the nearest 0.1 cm
- ☐ Raises sliding arm to its fullest height and performs second measurement
- ☐ If the first two measurements differ by > 0.5 cm, performs third and fourth measurements with proper breathing technique
- ☐ Reviews form for completeness
- ☐ Correctly completes form

9. References

1. Treuth MS, Hunter GR, Kekes-Szabo T. Estimating intra-abdominal adipose tissue in women by dual-energy X-ray absorptiometry. Am J Clin Nutr 1995;62:527-32.

2. van der Kooy K, Leenen R, Seidell JC, Deurenberg P, Visser M. Abdominal diameters as indicators of visceral fat: comparison between magnetic resonance imaging and anthropometry. Br J Nutr 1993;70:47-58.

3. Svendsen OL, Hassager C, Bergmann I, Christiansen C. Measurement of abdominal and intra-abdominal fat in post menopausal women by dual energy x-ray absorptiometry and anthropometry: Comparison with computerized tomography. Int J Obesity 1993;17:45-51.

4. van der Kooy K, Leenen R, Seidell J, et al. Waist/hip ratio is a poor predictor of changes in visceral fat. Am J Clin Nutr 1993;57:327-333.

5. Kahn HS. Background on the abdominal diameter index and suggestions for measurement of the supine abdominal diameter, mid-thigh girth, and waist girth. Emory University, July 21, 1996, and personal communication.

10. Form