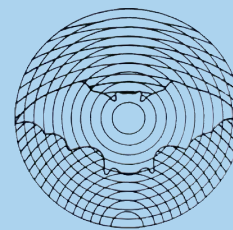


Dansk Ultralyddiagnostisk Selskab



Ultrasonography education for master in physiotherapy students – teaching master in physiotherapy students ultrasonography to be used in their daily work

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In 2019 Aalborg University, Denmark, started a new 2-year full-time master program in musculoskeletal physiotherapy. It aims at bachelors of physiotherapy with or without previous clinical experience. As ultrasonography is increasingly used in physiotherapy practice, the new program includes an elective course on musculoskeletal ultrasonography during the 3rd semester.

► **Table 1** Main elements of the ultrasonography course.

AIMS¹

Knowledge

Have knowledge about the musculoskeletal system, including structural and functional anatomy relevant to diagnostic muscular-skeletal ultrasonography

Have in-depth knowledge of using ultrasonography for diagnosing common musculoskeletal conditions in the extremities and trunk (abdominal wall, pelvic floor, sacroiliac joint, spinal joints)

Have in-depth knowledge of how to appropriately interpret findings on ultrasonography images

Skills

Understands indications and contraindications for using ultrasonography, as well as when ultrasonography is not appropriate and referral to other imaging modalities should be considered.

On the basis of other clinical findings perform an ultrasonography and integrate this into differential diagnostic considerations

Competences

Can use ultrasonography to aid in diagnosing common musculoskeletal disorders and identifying abnormal findings

TEACHING FORMS

- Lectures on ultrasonography physics, scanning technique, normal anatomy and pathology (plenum)
- Discussion of clinical cases (plenum)
- Supervised hands-on training (small groups)
- Unsupervised hands-on training (small groups)
- Examining patients with various pathologies integrating history, clinical findings, and ultrasonography finding (in a general practice clinic)
- Written feed-back on uploaded ultrasonography images (180 images per individual)
- Written feed-back on clinical cases integrating patient history, clinical and ultrasonography findings (20 per small group)
- Written and oral presentation of evidence for clinical question regarding use of ultrasonography (2 per small group)
- Written and oral presentation of teaching material (action cards) for peers to use ultrasound (2 per small group)

Teaching material

- European Society of Musculoskeletal Radiology, "Technical Guidelines² Fundamentals of Musculoskeletal Ultrasound" Edition 3, Jon A. Jacobson, Elsevier 2018

Examination

- Case-based demonstration on a healthy volunteer using relevant examination technique for an anatomical region which is evaluated in line with the OSAUS assessment
- Describing and interpreting 2 pictures of pathology
- Pass/fail evaluation

¹ <https://www.youtube.com/watch?v=wikezqxjyNg> (assessed 25 August 2024)

² <https://www.essr.org/subcommittees/ultrasound/> (assessed 20 August 2024)

► **Table 2** Outline of a typical scanning session and for the semester.

Plan for a scanning session covering an anatomical area (half a day)

1. Self-directed scanning of the anatomical region¹
2. Lecture on relevant anatomy, scanning technique, pathology
3. Ultrasound demonstration of scanning technique
4. Supervised hands-on training in small groups
5. Pathology cases

Plan for the semester

1. Introduction – basic ultrasonography theory (½ day)
2. Lower extremity sessions: hip, knee, ankle, and foot (4½ days)
3. Presentation of in-depth assignment (literature search) and action card regarding the lower extremity (½ day)
4. Clinical examination including ultrasonography of patients with lower extremity pathologies at general practice clinic (½ day)
5. Trunk: pectoralis, pelvis floor, sacroiliac joint, spinous process, facet joints (½ day)
6. Upper extremity: shoulder, elbow and forearm, wrist and hand (3 days)
7. Presentation of in-depth assignment (literature search) and action card regarding the upper extremity (½ day)
8. Intervention technique (½ day)
9. Clinical examination including ultrasonography of patients with the upper extremity pathologies at general practice clinic (½ day)
10. Examination (½ hour per student)

¹ Inspired by a productive failure approach we let them scan the curriculum of the day prior to the teaching session. See <https://youtu.be/VOKJmg34wME> (assessed 20 August 2024)

The course has high priority and a large curriculum constituting a 10 ECTS credits module. It comprises 200 hours of self-study including theoretical and practical sessions, and roughly 100 hours of classroom lectures and supervised hands-on workshops. Considerable teacher capacity is allocated making a hands-on student-to teacher ratio off 4–6:1 possible. Ultrasonography equipment is available for self-study practice between sessions and the students are required to upload 180 scans for review by the teachers.

The overarching teaching principle is small-group problem-based learning. Students work in groups of 2–3 sharing a single scanner. Ultimately, the course aims to cover relevant clinical areas and achieving a minimum of EFSUM level 1 competence and for some elements level 2. (See ► **Table 1** for details).

To enhance the students' understanding of clinical diagnostic application, teaching sessions are relocated from the university to a general practice clinic midway and at the end of the semester. At the clinic approximately 10 patients are lined up for examination. They are selected to have various pathologies related to what had been covered in the lectures at the university leading up to the clinical visit. The small groups of students rotate between patients, conducting first a brief interview followed by basic clinical examination, and finally an ultraso-

nography scan. In addition, the small groups work with clinical cases from their daily practice and hand in a written assignment of 20 clinical cases, including a description of the patients' history, findings from the clinical tests, and performance of the ultrasonography examination.

Training in evidence-based use of ultrasonography is a key component of the course. With this in mind, the course includes 2 problem-based assignments, where each group has to define and work with a self-selected clinical question regarding the use of ultrasonography, e. g. for patients seen in primary care, how sensitive and specific is ultrasonography in diagnosing median nerve compression compared to an electroneurogram? The groups then had to identify learning resources and identify relevant literature before producing a written report followed by a plenum presentation.

To enhance the students' ability to communicate and condense knowledge, they have to transform their literature review findings into a practical guidance for their peers. This was achieved by creating one-page action cards¹ that outlined how to scan, expected

findings and interpretation of these as well as possible pitfalls. These action cards are presented and discussed in plenum.

To introduce students to interventional procedures, the course includes a half-day session where students are trained in free-hand ultrasonography-guided steering of a needle. Initially, training entailed aiming the needle at waterfilled balloons and other artefacts embedded in gelatine. Later, the students perform procedures on joints in the distal legs of pig cadavers.

Since its inception, the course has been completed 4 times and the students consistently rate their learning outcomes to be very high. From the teachers' perspective it is fulfilling to engage in a course that integrates and advances clinical and academic skills. The review of the students' ultrasonography images is rather laborious, and it has been considered if this could be changed to a supervised peer-to-peer evaluation in the future. Other aspects, which have not yet been explored and could potentially enhance learning outcomes while reducing teacher involvement are using more on-line material, flipped classroom, webinars etc.

¹ <http://www.thieme-connect.com/products/ejournals/pdf/10.1055/a-2055-6554.pdf> (assessed 20 August 2024)