

## Utilization of Musculoskeletal Ultrasound in Daily Rheumatology Practice and Research

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### An Opportunity for Improved Diagnosis, Therapeutic Decision-making, and Understanding of Pathophysiology of Rheumatic Disease: The Canadian Experience

Utilization of point-of-care musculoskeletal ultrasound (MSK US) in daily practices of rheumatologists offers important benefits to clinical assessment alone, by facilitating more accurate diagnosis,<sup>1</sup> better therapeutic decision-making,<sup>2</sup> and a greater understanding of the underlying pathophysiology of rheumatic diseases.<sup>3</sup> MSK US can also provide objective measures of clinical outcomes.<sup>4,5</sup>

#### History of MSK US

The first reported use of MSK US was by Dussik and colleagues<sup>6</sup> who measured the acoustic attenuation of articular and periarticular tissues including skin, adipose tissue, muscle, tendon, articular capsule, articular cartilage, and bone. Subsequently, MSK US was applied to a MSK diagnosis to differentiate Baker's cyst from a deep venous thrombosis,<sup>6,7</sup> and since that time has been successfully used to investigate a wide range of soft tissue and bony pathologies.<sup>8,9</sup> The first demonstration of synovitis in rheumatoid arthritis (RA) was performed in 1978 by Cooperberg,<sup>10</sup> who correlated grey-scale images of synovial thickening and joint effusion in the knee with clinical and arthrographic findings before and after treatment with yttrium-90 injection. Several other studies have demonstrated that MSK US is better than clinical assessment in identifying small effusions or synovial proliferation and at evaluating early osteoarthritic changes and/or crystal deposition.<sup>1,10-13</sup> Many other advantages of MSK US have been recognized (Table 1).

The high-quality machines that are currently available provide sharply defined images with a high level of spatial resolution (down to 0.1 mm). In addition, power Doppler

capabilities, which demonstrate blood flow in the small vasculature, can act as a marker to identify local inflammation, and as a predictor of disease progression. Procedures can be carried out efficiently and are easily repeatable, thus providing an opportunity to monitor patient changes and responses to treatment over time. Furthermore, MSK US guidance provides more accurate needle placement, relative to surface anatomic guidance, for joint and bursa injections at various sites.<sup>15</sup>

#### Usage and Practice

MSK US may contribute to more effective disease management with earlier and more accurate detection of synovitis and implementation of optimal therapies. In Canada, this imaging modality provides a more timely evaluation than MRI, with a sensitivity that is equivalent at most sites, when evaluating soft tissue pathologies and bone erosions.

Some of the challenges preventing more rapid and widespread implementation of MSK US in daily practice include access to machines, adequate training programs with sufficient numbers of expert mentors, need for harmonization of standards of use at the local and international levels through the introduction of certification programmes, and necessary development of regulatory bodies, as well as establishing processes for reimbursement by public and/or private payers.

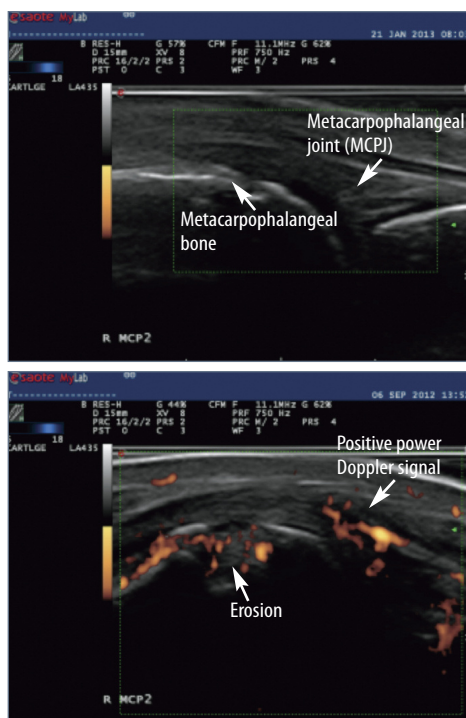
Interest in MSK US among rheumatologists has dramatically increased over the past decade<sup>7,16,17</sup> in response to its perceived utility in diagnosis and management of rheumatic and MSK disorders, as well as its potential for achieving better clinical outcomes. Europe and South America have been at the forefront of integrating MSK US into daily practice; ongoing initiatives for more than 25 years include the development of an educational framework and various training programs in these countries.<sup>18-20</sup> MSK US is part of subspecialty training in

several countries including Germany and Italy. In a recent questionnaire, it was recently reported that 80% of German rheumatologists use MSK US in daily practice.<sup>20</sup> A 2005 survey found that 93% of British rheumatologists use MSK US in managing patients, and 33% perform US assessments themselves.<sup>21</sup>

Although uptake among North American rheumatologists has been slower, the efforts of rheumatology societies have succeeded in raising practitioner awareness that bedside MSK US provides important benefits complementing clinical assessment. Use of MSK US quadrupled in the United States between 2000 and 2008. This increase is primarily by non-radiologists.<sup>19</sup> The American College of Rheumatology (ACR) has run an MSK US course for the past three years, and will soon launch a certification of competence examination for rheumatologists in MSK.<sup>22</sup> A train-the-trainers program has as its goal to train at least one teacher at each academic site across the nation. Results of a 2010 needs assessment completed by 156 Canadian rheumatologists reported that 50% of these physicians use MSK US in clinical practice, but only 7% of users performed the scans themselves, with 92% referring to radiology. In the latter group, more than 50% reported a delay of four weeks or longer for the imaging to be carried out. There is clearly an opportunity for improving efficiency by training rheumatologists in point-of-care MSK US.<sup>23</sup>

### CRUS: Development, Research, and Training

Led by Dr. Vivian Bykerk and Dr. Ed Keystone, a committed group of rheumatologists convened an initial meeting in Toronto in January 2009 with the aim of establishing a formal society to promote implementation of MSK US in daily practice and research, and to develop training and certification programmes. Through an unrestricted educational grant from Abbott (now Abbvie), the Canadian Rheumatology Ultrasound Society (CRUS) was inaugurated



US images of a normal metacarpophalangeal joint (top) and the same joint with RA (bottom).

in June 2010 and held its first meeting in September 2010. Dr. Bykerk, Dr. Karen Adams, Dr. Alessandra Bruns, Dr. Abe Chaiton, Dr. Maggie Larché, Dr. Johannes Roth, Dr. Michael Stein, Dr. Artur Fernandes, and the late Dr. Visithan Khy were the founding members.

The initial focus of CRUS has been on building competence in MSK US among rheumatologists. This is to be achieved through integrated hands-on teaching with e-learning (regular uploading of practice images, followed by expert review); Dr. Roth and Dr. Larché have led this initiative. As of May 2013, 65 rheumatologists had participated in the e-learning study, with an additional 25 currently in training. The course consists of three sets of weekend sessions; each session has a didactic and a hands-on training component,

including anatomy sessions at McMaster University. Participants engage in self-directed practice sessions during the weeks between weekend sessions. The uploading of images during this time to the CRUS website and expert review provides another learning modality.

Thus, since 2010, 12% of Canadian rheumatologists ( $n = 537$ ) have received training in MSK US. There are also moves to incorporate MSK US in the training programs for rheumatology fellows. A pilot scheme is near completion in Toronto, with 10 fellows being trained over the course of a year; these hands-on sessions are led by Dr. Chaiton, Dr. Larché, and Dr. Pooneh Akhavan. Self-directed practising of the technique, uploading to the CRUS website, and expert feedback are all a part of the training. Led by Dr. Bruns, the rheumatology fellows at Université de Sherbrooke have been learning US as part of their training for the past five years. In 2013-2014, Ottawa fellows will have the opportunity to learn MSK US with Dr. Roth.

A refresher/intermediate level course led by Dr. Bruns will be offered February 24-25, 2014, in the two days prior to the next Canadian Rheumatology Association (CRA)

meeting in Whistler, British Columbia. A certification day will be held the day following the CRA Meeting, consisting of a two-hour written examination and a one-hour supervised scan acquisition using randomly assigned joints and a predefined score sheet. An advanced level course will be planned subsequently at Université de Sherbrooke. Since 2009, Dr. Bruns has run basic and intermediate/advanced courses alternating each year; these are held predominantly in French.

A train-the-trainer initiative has begun, with Dr. Bruns leading a group of recently trained rheumatologists in best teaching techniques in US. Furthermore, during the CRUS courses, there are opportunities for more junior teachers to shadow an experienced trainer.

In his capacity as officer for training and certification, Dr. Roth has led the development of a WebEx curriculum in rheumatologic US. A series of web-based US tutorials, led by a national or international expert, cover aspects of ultrasonography including treating to target in RA, incorporating US into practice, and challenges of US in vasculitis.

Research is another focus of CRUS. Led by Dr. Michael Stein, the Prospective Observational Study to Evaluate the Use of MSK US to Improve Rheumatoid Arthritis Management: Canadian Experience (ECHO study) is a Canada-wide RA outcomes study with two arms (US and control groups). Another initiative is BIODAM, an international study of biomarkers in RA, with seven Canadian centres recruiting for the US arm. Smaller investigator-initiated studies include a foot imaging study in RA, development of a pediatric US atlas, and assessment of the utility of US in decision-making in patients with RA.

The practical aspects of implementation of MSK US are also being addressed by CRUS. These include reimbursement, improving access to machines, and advocating for inclusion of ultrasonography in the CRA Rheumatology Guidelines. In partnership with leading researchers, including Dr. Keystone, Dr. Boulos Haraoui, Dr. Bykerk and Dr. Denis Choquette, CRUS aims to increase the awareness of ultrasonography for rheumatologists, to incorporate US in a treat-to-target initiative, and to



Dr. David Bong, of the University of Barcelona, provides an anatomy demonstration.

increase the funding base for rheumatologists to be reimbursed for these procedures.

CRUS aims to ensure that the society represents all Canadian rheumatologists interested in MSK US; this will be accomplished by establishing a National Board that will advise the Executive of CRUS. This National Board would enable the creation of a database of rheumatologists interested in MSK US in Canada. CRUS has likewise undertaken an initiative to develop an image bank, a modular series of images for training purposes. The hip modules have been recently completed by Dr. Bruns. A password-protected “members-only” website is also being

developed which includes content for further study by recently trained rheumatologist ultrasonographers.

### CRUS: Activism and International Efforts

Canadian rheumatologists involved with MSK US maintain a high profile at the international level. They participate in MSK US training courses offered at ACR and European League Against Rheumatism (EULAR) meetings and the Barcelona sonoanatomy course (held in February each year). Similarly, several international tutors participate in the Canadian basic weekend course. A number of Canadian rheumatologists also are involved in the Outcome Measures in Rheumatology (OMERACT) groups related to ultrasonography. Furthermore, Dr. Chaiton and Dr. Roth have been participating in the ACR certification endeavour as invited members of the Musculoskeletal Ultrasound Certification in Rheumatology (RhMSUS) Examination Development and Review Group for the ACR.

Dr. Larché and Dr. Roth are ambassadors for the Targeted Ultrasound Initiative (TUI), an international effort to use MSK US in a treat-to-target approach for RA.<sup>24</sup> Dr. Chaiton is also a member of the Ultrasound Committee of the American Association of Neuromuscular and Electrodiagnostic Medicine (AANEM).

CRUS is part of a multidisciplinary group developing a point of care ultrasonography Diploma with the Royal College of Physicians of Canada. Through these and

future endeavours spearheaded by CRUS, the number of Canadian rheumatologists with sufficient expertise to use US in daily practice and monitor patients with MSK diseases will continue to grow until this becomes a widespread practise. CRUS strongly encourages Canadian rheumatologists to take part in the upcoming training opportunities:

• **Université de Sherbrooke MSK US:**

- Basic and intermediate/advanced courses available.
- For further information, please contact Dr. Bruns ([alessandra.brun@usherbrooke.ca](mailto:alessandra.brun@usherbrooke.ca)).

• **CRUS Course:**

- **Basic:** September 21-22, 2013 and February 1-2, 2014 at McMaster University, and on May 25-26, 2014 at Lake Muskoka. .
- **Refresher/Intermediate:** To be held February 24-25, 2014 prior to the CRA Annual Meeting in Whistler, B.C.
- For further information, please contact Ms. Alyssa Long ([along@cheo.on.ca](mailto:along@cheo.on.ca)).

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