Radiographic analysis of trochlear notch sclerosis in the diagnosis of osteoarthritis secondary to medial coronoid disease

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Summary
Trochlear notch sclerosis (TNS) as assessed by radiography has been shown to be increased in elbow dysplasia (ED) associated medial coronoid process disease (MCD). The aims of this study were to investigate whether two defined radiographic tests evaluating TNS would increase the sensitivity of detecting osteoarthritis secondary to MCD, and to assess whether there was a correlation between increasing TNS with severity of MCD. Sixty-one dogs with MCD (121 elbows) were selected from the imaging database. The controls were nine cadavers (18 disease-free elbows). Standard International Elbow Working Group radiographs and CT scans were taken of each elbow. Plain radiographs were analysed using various assessments: osteophyte grade (0–3), coronoid grade (0–3), TNS descriptive grade (0–3) and TNS ratio. The TNS ratio was calculated from the depth of ulnar sclerosis at the level of the disto-cranial margin of the humeral condyles divided by the crano-caudal ulna depth. The TNS descriptive assessment and ratio both increased the overall sensitivity of diagnosing osteoarthritis secondary to MCD above the other radiographic tests. The sensitivity of the TNS ratio at <0.3 mm was 91%-96% and the TNS descriptive assessment was 77%-96%. Radiographic TNS significantly increased with increasing severity of coronoid disease grade as evaluated by CT p<0.01. The finding that TNS increases the sensitivity of diagnosing osteoarthritis secondary to MCD is valuable to those that have neither a CT scanner nor arthroscopy readily available. The assessments described in this study are easy to apply and do not require any sophisticated technology in order to detect sclerosis.

Keywords
Trochlear notch sclerosis, medial coronoid disease, elbow dysplasia

Introduction
Medial coronoid process disease (MCD) is a term that represents a spectrum of pathologies which affect the medial coronoid process, including fragmentation of the medial coronoid process (1, 2). MCD is one of the abnormalities seen in elbow dysplasia (ED); the other lesions regularly included are ununited anconeal process, and osteochondrosis or osteochondritis dissecans of the medial humeral condyle (3). Some authors also include elbow joint incongruency (4, 5). MCD is the most common manifestation of ED (6–9), and, according to many studies, it is the most frequent cause of thoracic limb lameness in young, large breed dogs (10–18). ED is the most common cause of elbow osteoarthitis (19). It is therefore of paramount importance that this disease is diagnosed in general practice in order to allow appropriate therapy, specialist referral (if required) and client education to be commenced as early as possible. Radiographic signs of MCD are well documented and are based on the early signs of osteoarthitis (13, 20). It is known that the radiographic diagnosis of MCD is difficult, with poor sensitivity compared to advanced imaging modalities, such as computed tomography (CT) and magnetic resonance imaging (MRI) (20–23), but radiology still remains the primary imaging modality in general practice. Trochlear notch sclerosis (TNS) is a radiological term which describes increased bone radio-opacity in the region of the ulnar trochlear notch, although the term sclerosis means a hardening. It is thought to be due to three different pathological processes (24):

1) Increased density of the bone (e.g. enlargement of the trabeculae, reduced inter-trabecular bone marrow spaces and subchondral compaction);
2) Superimposed osteophytes, and periosteal/endosteal new bone;
3) Superimposed soft tissue mineralisation.

Radiographic evidence of TNS secondary to MCD has been described (25) and the international elbow working group (IEWG) include the use of TNS as part of their grading system for elbowarthrosis. The purpose of this study was to evaluate the reliability of qualitative and quantitative radiographic TNS assessment that could be easily transferred to general practice in order to increase the sensitivity of the radiographic diagnosis of arthrosis secondary to MCD. The primary hypothesis was that radiographic TNS tests increase the sensitivity of detecting MCD. The second hypothesis was that increasing TNS correlates with increasing severity of MCD as evaluated by CT.

Materials and methods
In this retrospective study the clinical database at the University of Glasgow Small Animal Hospital was reviewed from 2004–2007 in order to identify dogs that had undergone both CT and radiographic evaluation of the elbow joint. Additional recorded clinical information included: age, breed, sex, weight, duration of lameness, and the results of arthroscopy, if performed. The inclusion criteria for each dog were; 1) thoracic limb lameness localised to the elbow joint, 2) diagnostic quality radiographs...
Cases with incomplete medical records or any other pathology within the elbow were excluded. Elbows demonstrating MCD with concurrent incongruency were included.

Standard IEWG radiographic views of each elbow were obtained (neutral and flexed mediolateral and extended cranio-caudal), using a rare earth cassette (Quanta detail; DuPont) and high detail film (Cronex 10T; Agfar). Table top exposures were performed without the use of a grid and settings were adjusted depending on tissue thickness, according to pre-existing exposure charts. CT scans were obtained using a third generation scanner (Excel 2400 elite; Elscint). The dogs were sedated and placed in sternal recumbency, the forelimbs extended craniodistally, using a rare earth cassette (Quanta detail). The head was pulled caudally in order to avoid interference with the beam (26). The region to be scanned included the entire elbow articulation from the anconeus (26) to the radioulnar articulation distal to the cranio-distal margin of the humeral condyle in millimetres (A) and the cranio-caudal ulnar depth was measured in millimetres (outer cortex-outer cortex) (B) at the same level (Fig. 1A, B) 90° to the caudal ulnar shaft. The overall TNS ratio of sclerosis to ulnar depth was then calculated as A/B.

Computed tomograms were assessed for the grade of MCD on a categorical scale (Table 1). A group consensus was also obtained using a combination of the assessments of the CT scans for all of the observers for MCD. By simple majority, the consensus CT coronoid disease grade was used as the criteria for the diagnosis of MCD to which all radiographic assessments were related. This categorisation was termed ‘consensus’ and is treated as the gold standard for the diagnosis of presence and extent of MCD in this paper.

### Statistical analysis

Initial graphical analyses of the data were undertaken for each radiographic measurement and for each observer. Kruskal-Wallis analyses were used in order to compare the TNS ratio results between levels of consensus for each observer and follow-up comparisons were undertaken using Mann-Whitney tests, adjusted for multiple comparisons.

The sensitivity of each imaging test was calculated (dichotomising the results of the categorical data into presence (grade 1, 2 or 3) or absence (grade 0) of each radiographic feature and using varying cut-off values for TNS ratio) for the diagnosis of coronoid disease for each observer. Simple two by two tables and standard calculations were used for sensitivity calculations.

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT Corinoid disease grade</td>
<td>0</td>
<td>normal coronoid as detected by CT</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>altered attenuation</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>fissured coronoid</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>fragmented coronoid</td>
</tr>
<tr>
<td>Radiographic osteophyte grade</td>
<td>0</td>
<td>no osteophytes</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>largest osteophyte &lt; 2mm</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>largest osteophyte 2–5mm</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>largest osteophyte &gt; 5mm</td>
</tr>
<tr>
<td>Radiographic medial coronoid disease grade</td>
<td>0</td>
<td>normal coronoid</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>mild change in coronoid shape</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>marked change in coronoid shape</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>fragmented coronoid</td>
</tr>
<tr>
<td>Trochlear notch sclerosis (TNS), mediolateral projection, qualitative (descriptive) grade</td>
<td>0</td>
<td>no sclerosis</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>mild sclerosis, trabecular pattern still easily seen</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>moderate sclerosis, trabecular pattern slightly unclear</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>severe sclerosis, trabecular pattern cannot be seen</td>
</tr>
</tbody>
</table>

### Table 1 Descriptions of the assessments made for CT and radiographic analyses.
Inter-observer agreement was assessed using weighted Cohen’s Kappa statistics for the categorical outcomes (radiographic osteophyte grade, MCD grade, TNS description and CT coronoid disease grade) and intraclass correlation coefficients for the continuous measure of TNS ratio. Statistical analyses were performed using Minitab® Statistical Software version 15 and StatsDirect Statistical Software; (StatsDirect Ltd., 2005, Coventry, UK).

Results

Sixty-one patients met the inclusion criteria of the diseased population. These 61 patients had 121 elbows examined and of these, 12 were found to be non-diseased on CT examination. The median age of the dogs was 12 months (range: 5–108 months), and the median weight was 28 kg (range: 18–46 kg). Male dogs were mildly more affected than female dogs (52% and 48%, respectively). The median duration of lameness was two months (range: 1 week to 48 months), and 80.3% (49/61) of the cases were affected bilaterally. Labrador Retrievers were over-represented (49%, [30/61]), and a variety of other breeds were also identified (Table 2). Of the 121 elbows, 66 arthroscopies were performed, all of which were positive for MCD. Only one elbow had arthroscopic MCD which was not detected by CT (Table 2).

There was moderate to substantial inter-observer agreement with most assessments (p<0.01), for categorical data Kappa was between 0.40 – 0.72 and intraclass correlation coefficients for continuous data were between 0.46 – 0.61. Therefore, the comparison of consensus and radiographic assessments (osteophyte grade, radiographic coronoid disease grade, TNS descriptive grade and TNS ratio) of elbows are only displayed for observer one (Figs. 2–6). Only observer three for TNS descriptive assessment had slight to moderate agreement with the other observers Kappa 0.1 – 0.2. Fig. 5 represents TNS ratio scores for each observer compared with a dichotomised consensus outcome, showing that TNS ratio increased in MCD positive elbows.

Kruskal-Wallis tests revealed a difference in the median values of TNS ratio between consensus categories for all of the observers (p<0.001 for each observer), and follow-up comparisons showed that there were significant differences between categories 0 and 1 for observers 1 (p=0.018) and 2 (p=0.006) and approaching significance for observer 3 (p=0.053). Significant differences were also present between categories 0 and 2, and 0 and 3, respectively, for all of the observers (p<0.001).

The results for calculations of sensitivity for each radiographic assessment are presented in Table 3. The TNS description and ratio with a cut off <0.3 mm had a higher sensitivity than the osteophyte or coronoid disease assessments.

Discussion

The purpose of this study was to evaluate the usefulness and reliability of qualitative and quantitative radiographic TNS assessments that could be easily transferred to general practice in order to increase the sensitivity of the radiographic diagnosis of osteoarthritis secondary to MCD. This study showed that our radiographic TNS assessments increased the sensitivity of detecting MCD, and that increasing TNS correlated to increasing grade of MCD as evaluated by CT.

It has previously been shown that radiography is inferior to CT at detecting MCD, particularly as it mainly relies on arthrosis secondary to the disease. Carpenter and
others (1993) showed that CT had an accuracy of 86.7% compared to radiography, 56.7% (20). The current study does not refute that CT is a superior imaging technique for the diagnosis of MCD. CT has many advantages over plain imaging, including lack of superimposition of bony structures, multiplanar viewing, the ability to reconstruct images, enhanced contrast, improved definition of the coronoid process and degree of MCD and the ability to detect other lesions which may be the cause of elbow lameness, such as incomplete ossification of the humeral condyle (27). The purpose of this study was to aid practitioners who do not have access to a CT scanner or arthroscopy in the diagnosis of arthritis secondary to MCD, and to highlight that TNS is an important radiological sign that is highly sensitive for the diagnosis of arthritis secondary to MCD, particularly when combined with the other radiographic signs.

In an attempt to make the TNS descriptive evaluation quantitative and to measure the extent of sclerosis, we describe a simple technique of measuring the TNS ratio. This ratio was measured in the coronoid region of the trochlear since Burton et al. (2007) had described this area as having the greatest radiopacity (25). As hypothesised, the TNS ratio was significantly greater in diseased dogs and, similar to the descriptive assessment, increased the sensitivity of diagnosing arthritis secondary to MCD. Of particular note was that diseased elbows without any secondary osteophytes were more likely to be detected using the TNS description and/or ratio assessments, than would otherwise have been the case. The ratio number of < 0.3 mm should not be taken as definitive as there are many variables which may influence this, such as patient positioning, radiographic quality and observer measuring ability. For example, a measurement variation of 1 mm may make the difference between whether the elbow is categorised as diseased or not and this is of particular importance if there are not any other radiographic signs indicative of disease. TNS assessment is affected by radiographic quality, (exposure, beam centering, patient position, collimation and film/screen system used), hence it is of paramount importance to ensure high quality imaging if evaluation of TNS is to be used for the assessment of osteoarthritis (20).

The radiographic TNS descriptive assessment was highly sensitive (77–96%) in detecting osteoarthritis secondary to MCD. Grading systems have been developed which now include TNS (such as the IEWG and Lang’s scoring systems), but to our knowledge there are not any estimates of the sensitivity of these systems, neither as subjective assessments nor in combination with the other radiographic signs of ED (28). Our results concur with those of Burton and others (2007) who demonstrated that there was a statistically significant relationship between trochlear notch radiopacity and MCD using quantitative digital analysis (25). However TNS is not specific to MCD. It is a radiographic sign indicative of increased bone hardening, which can occur in many pathological conditions, including the other manifestations of elbow dysplasia, incomplete ossification of the humeral condyle, trauma, abnormal loading of the limb and neoplasia. Therefore, TNS must be used simply as an indicator to investigate the elbow further, for example by CT or arthroscopic assessment.

A limitation of our study is the lack of ability to obtain estimates for accuracy, specificity and predictive values for the use of TNS in the diagnosis of MCD. The population used in the current retrospective study was biased due to the lack of availability of CT scans of animals with other manifestations of elbow disease (other than incongruency). For example, observer three had a higher sensitivity but may have had a lower specificity at detecting TNS due to inexperience and likely over-interpretation of the radiograph, this may occur in practice. Intra-observer analysis of TNS would have improved the validation of our results. Further studies in these areas would be beneficial. Despite this, our high sensitivity results show that TNS is a useful screening test and may be used as a test to rule out MCD. In the authors’ opinion, while false positive results may occur, it is preferable to over diagnose and pursue further diagnostics, in order to enable the commencement of therapy in a timely manner, than to wait for more traditionally relied on radiographic signs of osteoarthritis to be detected, such as osteophytes.

The radiograph coronoid assessment had a poor sensitivity (58% – 63%), which is comparable to other studies with ranges reported between 10–62% (20, 29, 30). It is difficult to interpret the medial coronoid on a radiograph due to superimposition of the radial head and humeral condyle. The scores may have been improved if oblique views had been included, such as the distomedial-proximal-lateral oblique (Di35M-PrLO) (29). This was not available to us due to the retrospective nature of this study, and this is not a standard view used at our institute.

The osteophyte assessment concurred with previous studies showing it was only sensitive as an indicator of late signs of osteoarthritis (28, 31). Observer three had poor osteophyte assessment sensitivity and this is likely to be due to observer inexperience.

As the TNS ratio or descriptive grade increased so did the grade of coronoid disease. This was a general trend, and was more pronounced using the descriptive assessment than the ratio. This is likely because the ex-
tent of sclerosis (ratio) may not increase to a degree that can be measured, whereas there may be an increase of detectable radiopac-
ity. We therefore recommend that the de-
scriptive and ratio assessments are used to-
gether. It is not possible to use the TNS ratio
and descriptive assessments in order to de-
termine whether a coronoid is fragmented,
fissured or has decreased subchondral den-
sity since there is too great an overlap be-
tween the groups to give definitive cut off
points. Further diagnostics are required in
order to assess the severity of coronoid dis-
ease. In this study, CT was used to confirm
the presence or absence of MCD. Ideally, a
combination of arthroscopic diagnosis and
CT should be used to minimise misdiagno-
sis (32, 33). However, it has been shown that
the absence of CT or arthroscopic abnor-
malities does not rule out elbow lesions
(33). The collection of tissue at the time of
arthroscopy for histopathology would be
ideal (2), but the associated morbidity is un-
acceptable. Arthroscopy was not performed
in all of the cases for a number of reasons,
some of which being owner choice, finan-
cial concerns or the fact that lameness was
responding to conservative management.

Gross post mortem examination was per-
formed on all of the normal dog cadavers;
they were rejected if any signs of elbow pa-
thology were detected. It is accepted by the
authors that histopathology would have
been optimal since Danielson et al. (2006)
proved that fissuring occurs in the subchon-
dral bone before gross fibrillation of articu-
lar cartilage develops (2, 34, 35).

We assessed the grade of CT diagnosed
MCD by group consensus of the appear-
ce of the medial coronoid process on CT trans-
verse image. Individual variation has been
shown in grading MCD (5). The observers
did not have any difficulty interpreting
whether the coronoid was fragmented
(group 3) or not, but there was discussion
when differentiating between hypoattenu-
ation (group 1) and fissuring (group 2).

Tromblee et al. (2007) concluded that the
diagnostic certainty for altered subchondral
bone density was primarily influenced by
window setting and was optimized at a
width of 3,500 HU and window level of 500
HU (5). Whereas structural medial coronoid
process abnormalities were influenced most

![Fig. 2](chart_of_radiographic_osteoarthrosis_grade_versus_computed_tomography_CT_consensus_grade_for_observer_one_where_0_normal_coronoid_as_detected_by_CT_1_altered_attenuation_2_fissured_coronoid_and_3_fragmented_coronoid.png)

**Fig. 2** Chart of radiographic osteoarthrosis grade versus computed tomography (CT) consensus grade for observer one, where 0 = normal coronoid as detected by CT; 1 = altered attenuation; 2 = fissured coronoid; and 3 = fragmented coronoid.

![Fig. 3](chart_of_radiographic_medial_coronoid_disease_grade_versus_computed_tomography_CT_consensus_grade_for_observer_one_where_0_normal_coronoid_as_detected_by_CT_1_altered_attenuation_2_fissured_coronoid_and_3_fragmented_coronoid.png)

**Fig. 3** Chart of radiographic medial coronoid disease grade versus computed tomography (CT) consensus grade for observer one, where 0 = normal coronoid as detected by CT; 1 = altered attenuation; 2 = fissured coronoid; and 3 = fragmented coronoid.
by image plane, the transverse plane being the most favourable. In our study, we followed those recommendations in an attempt to maximize our sensitivity in detecting severity of MCD.

There was a general agreement amongst observers for the radiographic assessments, though from the sensitivity results it can be clearly seen that observer 3 had a greater sensitivity for TNS. This is likely due to inexperience and over-interpretation of the degree of trochlear notch radiopacity. Inter-observer variation also reflects the observer noise inherent in the decision-making process, for example, if a fragmented medial coronoid process or osteophytes are observed or the contralateral limb has signs of osteoarthritis, then the observer may have greater certainty that the elbow is diseased and this may bias their judgment when inspecting the degree of TNS (36). A recent study by Tromblee and others also found this, whereby observers had a greater diagnostic certainty for normal elbows than for dysplastic elbows (5).

The median age of our diseased groups of 12 months and median weight of 28 kg was similar to other studies (37, 38). The over-representation of Labrador Retrievers is supported by many studies (10–12, 16, 32, 38, 39). The lower number of breeds, such as German Shepherd Dogs, Rottweilers, Springer Spaniels, Bernese Mountain Dogs, and Mastiffs, is likely to reflect a lower overall number of these breeds in the referred dog population but may also be due to our exclusion criteria. For example, most Springer Spaniels that had MCD also had incomplete ossification of the humeral condyle. Many studies show that male dogs are clinically more affected than females and our study supported this albeit not as strongly as other studies (1, 30, 40–43), which again may be due to our stringent exclusion criteria.

In our diseased dog population, 80.3% were bilaterally affected, a finding which is similar to previous reports (19, 44, 45). In our clinic, both elbows are imaged regardless of whether the dog is clinically affected bilaterally or unilaterally. This is to help prevent diseased but clinically ‘silent’ elbows from being missed. However, it is still possible that a normal CT is seen with a histologi-
Radiographic analysis of trochlear notch sclerosis\textsuperscript{(5)}. This may have reduced the sensitivity results. Further assessment of all of the elbows by arthroscopy would have allowed a more detailed examination of the coronoid process and may have improved the identification of diseased elbows\textsuperscript{(9)}. There were 12 contralateral elbows within the clinical cases which did not have CT evidence of MCD yet in some cases the observers assessed these elbows radiographically as having TNS sclerosis (Fig. 4). As previously mentioned, this may have been because of bias due to the observation of more convincing evidence of osteoarthritis in the opposite elbow (39), or for a pathophysiological reason that cannot be determined from this study.

Trochlear notch radiopacity is not a direct measurement of bone density itself. Our study may have been further validated by using computed tomographic osteoabsorptionmetry (46–48), or dual-energy x-ray absorptiometry (49). The reason for the increased radiopacity with MCD and why this is increased with increasing severity of disease is unknown. In humans, increasing bone mineral density has been found in osteoarthritis of the knee\textsuperscript{(50)} and it may be that this is also true with osteoarthritis of the elbow in dogs. Pathological humeroulnar incongruency may also play a role in this due to eccentric loading of the joint (25). Conversely, other studies have indicated that humeroulnar incongruency may also be a normal finding in both humans (51) and dogs\textsuperscript{(52)}.

In summary, this study demonstrates that radiographic assessments of TNS increases the sensitivity of diagnosing arthritis secondary to MCD. This technique is likely to be valuable to veterinarians who have neither a CT scanner nor arthroscopy readily available. Specificity has been unable to be elucidated from this study; therefore further diagnostics are required to rule out other causes of elbow disease. The assessments described in this study are easy to apply in general practice and should be used as a screening test for diagnosing arthritis secondary to MCD.

Acknowledgements
The authors acknowledge and thank Professors D. Bennett and M. Sullivan for proofing the paper.

Table 3 Sensitivity results for each observer for the radiographic and CT assessments for the diagnosis of osteoarthritis secondary to medial coronoid disease. 95% confidence intervals are in brackets. Trochlear notch sclerosis (TNS) sensitivities have been shown for cut off points of 0.3 mm-0.6 mm. Sensitivities for diagnosis of CT coronoid disease assessment versus consensus are also shown.

<table>
<thead>
<tr>
<th>Imaging assessment</th>
<th>Sensitivity (true positive proportion)</th>
<th>95% confidence intervals are below in brackets</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Observer 1</td>
<td>Observer 2</td>
</tr>
<tr>
<td>Radiographic osteophyte assessment</td>
<td>0.72 (0.63–0.80)</td>
<td>0.74 (0.65–0.82)</td>
</tr>
<tr>
<td>Radiographic medial coronoid disease assessment</td>
<td>0.63 (0.54–0.72)</td>
<td>0.63 (0.54–0.72)</td>
</tr>
<tr>
<td>Radiographic TNS description assessment</td>
<td>0.89 (0.82–0.94)</td>
<td>0.77 (0.69–0.85)</td>
</tr>
<tr>
<td>Radiographic TNS ratio cut off &lt;0.3 mm</td>
<td>0.96 (0.91–0.98)</td>
<td>0.91 (0.85–0.96)</td>
</tr>
<tr>
<td>Radiographic TNS ratio cut off &lt;0.4 mm</td>
<td>0.71 (0.62–0.79)</td>
<td>0.55 (0.45–0.64)</td>
</tr>
<tr>
<td>Radiographic TNS ratio cut off &lt;0.5 mm</td>
<td>0.24 (0.18–0.33)</td>
<td>0.19 (0.12–0.28)</td>
</tr>
<tr>
<td>Radiographic TNS ratio cut off &lt;0.6 mm</td>
<td>0.02 (0.003–0.06)</td>
<td>0.04 (0.01–0.09)</td>
</tr>
<tr>
<td>Radiographic TNS description + ratio &lt;0.3 mm combined in parallel</td>
<td>0.97 (0.92–0.99)</td>
<td>0.91 (0.84–0.96)</td>
</tr>
<tr>
<td>Radiographic osteophyte/coronoid/TNS description/TNS sclerosis ratio &lt;0.3 mm combined in parallel</td>
<td>0.98 (0.94–0.99)</td>
<td>0.93 (0.87–0.97)</td>
</tr>
<tr>
<td>CT coronoid disease assessment versus consensus</td>
<td>0.89 (0.82 – 0.94)</td>
<td>0.79 (0.70–0.86)</td>
</tr>
</tbody>
</table>
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References


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