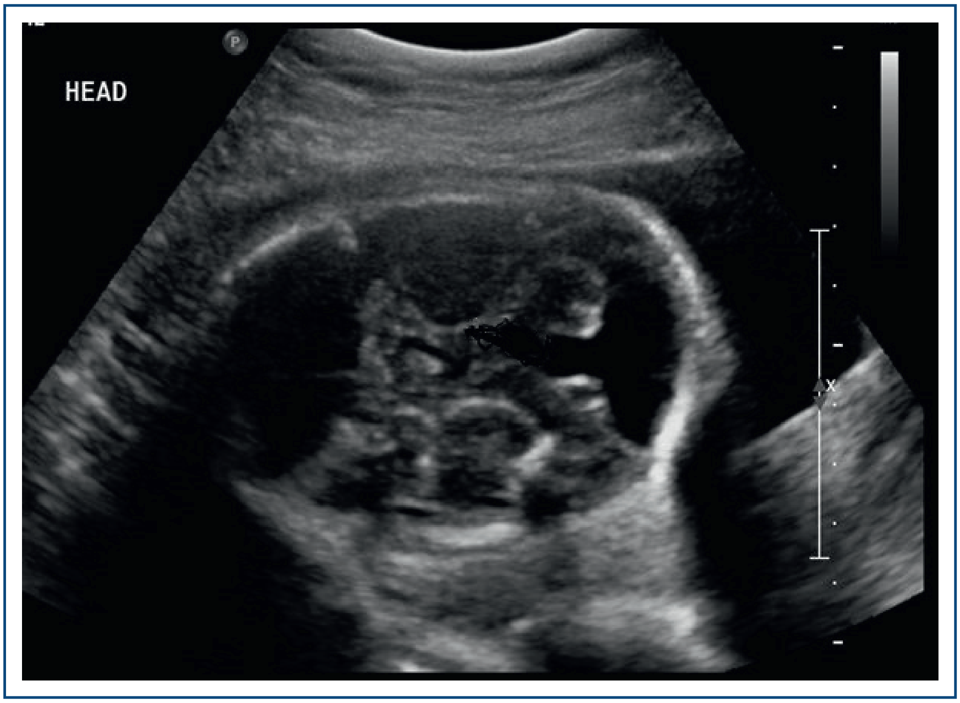
Volume 13, Issue 1 ▪ 2022

CJMS

Sonography Canada | Échographie Canada

Canadian Journal of Medical Sonography



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Volume 13, Issue 1 • 2022

Publications Agreement Number 40025049

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Canadian Journal of Medical Sonography is published four times a year by Dougmar Publishing Group Inc., with offices located at 115 King Street West,Suite 220, Dundas, ON L9H 1V1.

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About the cover

This image is Figure 1 from the article Dandy-Walker Malformation by Mohamed Nashnoush.

Message from the Editor-in-Chief

Spring is in the air! COVID restrictions are gradually diminishing, and I feel hopeful that we can now manage this pandemic and get back to normal, albeit a new normal. Mental well-being and 'self-care' are top of mind for many of us, and opportunities for change in mind and attitude seem more possible now.

This issue of the CJMS brings you a practice change article by an interprofessional team consisting of Valerie Doyon, a third-year medical student at UBC, Stephen Tuomi, the sonography lead at Island Health Medical Imaging, and Chris King, a faculty member of the Medicine Department of Radiology at UBC. In the cover letter for their submission, the authors describe their research as an initiative to enhance best practice in standardized radiology reporting, specifically as it applies to ultrasound imaging. This review aimed to provide sonographers with evidence-based recommendations to improve their report writing, taking into account the latest research and standards from regulatory agencies. While the authors' review was conducted to inform Island Health's new standardised reporting structure, all sonographers can apply the outcomes across the country.

As a proponent of collaborative practice, I was really gratified to see another partnership in submitting a manuscript on the *Use of Duplex Ultrasound Imaging Post-Endovascular Aneurysm Repair(EVAR)*. This time, the co-authors are Heather Martin, Angus Hartery, and Ravindra Gullipalli from the Faculty of Medicine at Memorial University of Newfoundland. Their review provides an in-depth introduction, supported by ultrasound and CT images, of each of the five types of endoleaks. In addition, the article emphasizes the effectiveness of duplex ultrasound in screening for this finding.

The obstetric article on Dandy-Walker Malformation is a multi-study series with excellent evidence-based information on this abnormality that will be of interest to all generalist sonographers. The author is Mohamed Nashnoush, from the School of Health Sciences at Dalhousie University, Nova Scotia.

And finally, just as the sonography profession continues to evolve and change, so does the national association representing Canada's diagnostic medical sonographers. Read on to learn about the important changes to Sonography Canada's leadership team and how this evolution is expected to support members and the profession.

In this issue of CJMS it is good to see we have engagement from both the East & the West Coast of Canada! This issue is dedicated to all Canadian healthcare workers for what they do daily.

Sheena Bhimji-Hewitt

Broadening Horizons & Pushing Boundaries

*The opinion in this editorial is that of the Editor-in-Chief and not that of Sonography Canada or the Sonography Board of Directors.

Message du rédactrice en chef

Le printemps est dans l'air ! Les restrictions imposées par le COVID diminuent progressivement et j'ai bon espoir que nous puissions désormais gérer cette pandémie et revenir à la normale, même si c'est une nouvelle normale. Le bien-être mental et l'autogestion de la santé sont au cœur des préoccupations de nombre d'entre nous, et les possibilités de changement d'esprit et d'attitude semblent plus nombreuses aujourd'hui.

Ce numéro de la CJMS vous présente un article sur le changement de pratique rédigé par une équipe interprofessionnelle composée de Valerie Doyon, étudiante en troisième année de médecine à l'UBC, de Stephen Tuomi, responsable de l'échographie à Island Health Medical Imaging, et du Chris King, membre du corps enseignant du département de radiologie de l'UBC. Dans la lettre d'accompagnement de leur soumission, les auteurs décrivent leur recherche comme une initiative visant à améliorer les meilleures pratiques en matière de rapports radiologiques normalisés, notamment en ce qui concerne l'imagerie par ultrasons. Cet examen visait à fournir aux échographistes des recommandations fondées sur des preuves pour améliorer la rédaction de leurs rapports, en tenant compte des dernières recherches et des normes des organismes de réglementation. Bien que l'examen des auteurs ait été mené pour informer la nouvelle structure de rapports normalisés de l'Island Health, tous les échographistes peuvent appliquer les résultats dans tout le pays.

En tant que partisan de la pratique collaborative, j'ai été très heureux de voir un autre partenariat dans la soumission d'un manuscrit sur l'utilisation de l'imagerie par ultrasons duplex après une réparation endovasculaire de l'anévrisme (EVAR). Cette fois, les coauteurs sont le Heather Martin, le Angus Hartery et le Ravindra Gullipalli de la faculté de médecine de l'Université Memorial de Terre-Neuve. Leur étude présente de manière approfondie, images échographiques et tomodensitométriques à l'appui, chacun des cinq types d'endofuites. En outre, l'article souligne l'efficacité de l'échographie duplex dans le dépistage de ce type d'endofuite.

L'article obstétrique sur la malformation de Dandy-Walker est une série d'études multiples contenant d'excellentes informations factuelles sur cette anomalie qui intéressera tous les échographistes généralistes. L'auteur est Mohamed Nashnoush, de l'école des sciences de la santé de l'université Dalhousie, en Nouvelle-Écosse.

Enfin, tout comme la profession d'échographiste continue d'évoluer et de changer, l'association nationale représentant les échographistes diagnostiques du Canada fait de même. Poursuivez votre lecture pour découvrir les changements importants apportés à l'équipe de direction de Sonographie Canada et comment cette évolution devrait soutenir les membres et la profession.

Dans ce numéro de CJMS, il est bon de voir que nous avons des engagements de la côte Est et de la côte Ouest du Canada ! Ce numéro est dédié à tous les travailleurs de la santé canadiens pour ce qu'ils font quotidiennement.

Sheena Bhimji-Hewitt

Élargir les horizons et repousser les frontières

*L'opinion exprimée dans cet éditorial est celle du rédacteur en chef et non celle de Sonographie Canada ou du conseil d'administration de Sonography.

Literature Review

Valerie Doyon, BSc
Stephan Tuomi, RDMS EMBA
Chris King, MD FRCPC

Best Practice in Standardized Ultrasound Reporting

About the Authors

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ABSTRACT

The past couple of decades have seen a considerable rise in the standardization of imaging reports. Standardized reports are superior to traditional prose reports in multiple measures, including accuracy, clarity, comprehensiveness, and efficiency. Owing to clinical interactions between sonographers and radiologists, ultrasound has the potential to have tremendous benefits from standardized reporting. However, ultrasound examinations are reported to be notoriously challenging to standardize and receive low uptake. A narrative literature review was conducted using articles published from 1980 through May 2021. PubMed and Google Scholar were searched with terms such as ultrasound, sonography, standardized, report, and their Medical Subject Heading terms. This review discusses the advantages and disadvantages of standardized reporting and summarizes the literature regarding structure, content, language, measurements, and guiding principles to be considered when creating standardized reports. With a special focus on its uses in sonography, the aim of this article is to act as a helpful guide for ultrasound program leaders in the implementation of standardized reporting at their institutions.

Keywords: standardized, structured, report, ultrasound, sonography.

Introduction

With advancement of technology, there has been a strong move toward converting conventional handwritten reports to digital ultrasound reports. Ultrasound staff, in turn, has designed structured online forms, albeit with limited guidance available. As a result, a variety of online report templates are now available for every created imaging examination. This trend has precipitated a need for the standardization of reports among practitioners as well as between hospitals and even health authorities.[1] Fortunately, there is a growing body of evidence for the use of standardized reports (SR) in medical imaging. The American College of Radiology provides basic principles[2] on this topic, and the Radiological Society of North America has developed hundreds of sample report templates.[3] In addition, numerous authors have published lessons learned from their experience implementing standardized reports at their institutions. This literature review discusses the benefits and challenges of standardized reports, followed by the best practice and evidence-based suggestions about structure and content of reports. This review can be used as a guide by ultrasound leaders in implementing standardized reporting.

Methods

A narrative literature review was conducted using articles published from 1980 through May 2021. Both PubMed and Google Scholar were searched with a combination of keywords and terms in their Medical Subject Headings (MeSH): (Report OR Reporting) AND (Standardized OR Structured) AND (Ultrasound or Imaging or Radiology). The top 100 publications from each search engine were screened and those found relevant to the format, content, and language of imaging reports were included. Reference lists of selected articles were screened for additional pertinent articles and web pages. Subsequent references were cross-referenced and additional references were acquired.

Discussion

Benefits

Advantages of standardized reports are multifactorial. First, key components of report are not be omitted if elements are listed systematically in a standard template, and pertinent results are easier to extract if they are at an expected location.[4] From an institutional audit, Schwartz et al. brought to light the inconsistencies rampant in traditional prose reports and found that compared to conventional radiology reports, structured reports built with templates received significantly higher mean ratings for clarity and content by both radiologists and referring physicians.[5] The increased accuracy, clarity, and overall quality are the most studied advantages of standardized reports.[6] Interestingly, in one study, the use of a standardized ultrasound template was found to reduce annual imaging costs.[7] In addition, risk-stratification scores, such as Thyroid Imaging Reporting & Data System (TI-RADS),[8] can be automatically calculated,[9] improving efficiency and decreasing reporting errors.[10] For instance, if a specific soft marker abnormality such as an echogenic cardiac focus is observed during an obstetrical ultrasound, standardized recommendations regarding follow-up can be integrated into the report. Standardized report is especially useful in ultrasound, as measurements can be imported seamlessly from the ultrasound machine to the radiology report, preventing transcription mistakes.[11] More advanced software automatically transfer and translate sonographer observations over to the body of radiologist report. These advanced standardized report features improve communication and efficiency of both parties.

In the long-term, main advantage of a standardized report is the possibility of large-scale data mining, which can be used for clinical research, outcomes' analysis, education, and training.[12,13] The electronic format allows institutions to quickly incorporate user feedback, evolving scientific evidence and new practice standards by modifying existing forms. For instance, newly published normal values for ultrasound measurements can be easily updated. Standardized report has the potential to modernize and transform diagnostic ultrasound workflow and patient outcomes.

Challenges
Although worthwhile, standardizing ultrasound reports across a department is no small undertaking. Writing an imaging report template has been deemed “analogous to software programming.”[14] According to Reiner, implementing standardized report is “the most challenging for the radiology community as a whole”, primarily because of concerns regarding workflow and decreased productivity.[12] In reality, a study conducted by Hawkins et al. in 2012 demonstrated that the use of prepopulated reports alone neither affected the error rate nor dictation time of radiology reports.[15] In fact, reporting time was recently found to be significantly shorter using template-based structured reports than free-text reports.[13] Another commonly cited obstacle is the loss of autonomy,[6] as reports are the main works produced by sonographers and radiologists, each having individual style preferences.[16] However, in their study, Hawkins et al. found that radiologists in 86% cases manually selected a standardized template if presented with a blank screen, even though they had the option to dictate in prose.[15] Both major arguments against implementing standardized report appear ungrounded in practice.

Nonetheless, of all modalities, ultrasound examinations are especially difficult to standardize. In 2016, Tran and colleagues reported significant challenges with their implementation of ultrasound standardized reports.[17] In another study, of the two examination types with the lowest uptake were both ultrasound examinations: the renal and bladder ultrasound, and the complete abdominal ultrasound.[18] Thus, leaders attempting to switch to standardized report must expect challenges and should carefully consider the following insight shared by other groups.

Guiding Principles
Any mistakes and inefficiencies of an SR template are multiplied exponentially when rolled out across a health authority. All elements must be thought out deeply when creating an SR template. As Larson put it: “sweat the details.”[14] The concerns of sonographers, radiologists, and ordering physicians must be considered.[18] In order to achieve the most practical standardized report, the following competing principles must be optimally balanced: consistency versus flexibility, completeness versus conciseness, and required versus optional elements.[4] Given that the goal of an SR program is to standardize reporting of imaging across all staff in a group, its design must never be substantially compromised to meet a single individual’s preferences.[14]

While the template should not be allowed to be altered based on unique user preferences, its structure must be malleable to allow for the characterization of unique or complex imaging findings. A standardized report must be able to document the entire spectrum of rare pathological findings, even if they cannot be captured in the standard template’s fields. The competing interests of consistency versus flexibility can be balanced by having a free-text section available for out-of-the-box findings that cannot be accurately described within the normal constraints of a standardized report.

Report Structure
A radiology report should include the following basic categories: patient ID, date, examination type, examination quality and limitations, comparison with previous studies, indications, findings, and impressions.[2,19–21] There should be no impressions or interpretations in the findings section; it should be strictly a description of the findings at face value.[14] Findings must appear in a logical and predictable order, but there should be no restrictions on the language a radiologist uses in the impression section.[18] This is in accordance with the principle of balancing consistency and flexibility mentioned in a large imaging health policy statement, which recommends having the ability to modify the data captured by the reporting mechanism.[4] Thus, the findings section must be prepopulated in a standard fashion, but free text fields must be placed at the end of each organ’s section for sonographers to input rare findings. Along the same reasoning, the impression section should be

a block of free text where the radiologist can write their unique interpretations of imaging findings.

Almost 92% referring physicians preferred inclusion of radiologist's impressions or conclusions.[22] Only 32% of referring clinicians preferred the summary statements to be at the beginning of the report.[23] Together, these preferences indicated that the impressions section should always be included and placed in the last section of the report. In addition, in 2018, focus groups found that clinicians preferred the impressions to be written in sentence case rather than in all capital letters.

There is a lack of consensus in literature on the use of bullet-point lists versus full sentences in reports. According to Larson, at one institution, it was decided that "[f]ull sentences should be used in paragraphs and sentence fragments are acceptable as part of ordered lists,"[14] whereas the American College of Radiology sample reports (e.g., Breast Imaging-Reporting and Data System [BI-RADS]) are composed primarily of nonsentences. In a study conducted in 2001, questionnaires sent to radiologists and referring physicians indicated that itemized lists were preferred over prose reports.[24] In the free-text fields of itemized reports or if prose reporting is used, short sentences are preferred over long sentences.[19] Although the subject remains controversial in the literature, the efficient transferring of information does not require complete sentences and this is more a matter of style.

Content

The literature underscores "concision" as a core attribute of a good radiology report.[12,19] Nonetheless, sufficient details must be provided in order to allow the person reading the report to visualize mentally the described findings. A survey of referring physicians established that they desired brief reports but would still want to know what has been examined and what has been lost.[25] Given that most modern reports are itemized, this indicates that structured reports must list the organs examined, each specified "normal" or with a longer description if abnormal.[19] Most physicians also prefer that the findings are listed in the same order, as opposed to grouping abnormal findings separately from the normal organs, which is in concordance with the overarching goal of standardization of reports.[24] However, for the impressions section, items must be ordered by the importance of findings.[26]

The preferred method of moving between fields must also be considered, such as a mouse click on a field, or the use of picklists.[18] A useful design principle is the SR template defaulting to a "normal" examination with minimal editing.[14] Goldberg-Stein and colleagues also recommended pre-populating normal statements.[18] Another takeaway from their SR initiative is that "normal statements in the structured report should be based on commonly accepted practice rather than cutting edge research, which may not be accepted by all radiologists or understood by many non-subspecialty clinicians."[18] Since most organs are normal, a "NAD" (normal) default selection for each organ saves time. The American College of Radiology suggests that the report must, when appropriate, identify potential limitations. Therefore, we recommend the use of an "NWS" (not well seen) button and follow-up fields to specify which area of the organ must not be visualized.

Language

Clarity has been reported as the most valuable attribute of a report.[27] The passive voice ("is seen") must be limited and the present tense is preferred.[28] Non-contributory language, that is, "is noted," "unremarkable," etc. must be avoided.[14] In order to lessen ambiguity, use of acronyms or abbreviations must be minimized.[2,19,21] Tautological phrases such as "oval in shape," "close proximity," "small in size," "slightly anechoic," and "direct comparison" are to be avoided.[28] Reports by Coakley et al. and Necas offer a number of other useful phrasing guidelines, such as removing "there is," "there are," "significant," and "cannot be excluded."[21,26]

Acoustic descriptions of ultrasound findings are rarely useful, since they can be poorly understood by the referring physician.[30] For example, "the liver is hyperechoic and attenuating" must be rewritten as "fatty liver." Avoid technical jargon as much as possible.[29] Since the radiology report is an official medicolegal document, lay language, such as "blood clot" and "bright," is also inappropriate.[30]

Standardized reporting language has been attempted by many large governing organizations such as BI-RADS, RadLex, the Systematized Nomenclature of Medicine, and the Universal Medical Language System, just to name a few. Unfortunately none of these initiatives are currently comprehensive enough to be put in practice as a universal lexicon, but this is likely to change in the future.[12]

Measurements

Most generalists do not know the normal size range of organs: in one study they were found to be confused when the size of a structure was given without an explanation of its relevance.[22] In the study conducted by Naik et al. in 2001, only 25% of clinicians and 24% of radiologists valued knowing the size of normal organs whereas, if abnormal then 85% and 92%, respectively, of those physicians wanted measurements.[24] Thus, it is best to only provide measurements in instances where the organ is abnormally small or large, otherwise it is preferable to avoid burdening clinicians with numerical sizes and rather state that a structure is of "normal caliber."[30] Measurements must be cited to norms for body size, gender, and age.[4]

Conclusion

Standardized reporting is a rapidly growing trend, but the practice is not yet adopted by all sonography departments. Standardized report allows for significant improvements in the quality of written ultrasound reports and are preferred by both radiologists and referring physicians. The benefits by far outweigh the disadvantages. The loss of autonomy and other concerns may be lessened by a thorough involvement of imaging staff into SR design via a consensus-based process. For a successful implementation of a SR program, every aspect of the template must be scrutinized. Applying the lessons shared by other departments who have endeavoured to standardize their reports constitutes a useful starting point for implementing an SR ultrasound program. Comprehensive guidelines of radiology society and more advanced software technology are required for standardized report to become the new standard of care.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

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Article Title: Best Practice in Standardized Ultrasound Reporting: A Literature Review

Authors' Names: Valerie Doyon, BSc; Stephan Tuomi, RDMS, EMBA; Chris King, MD, FRCPC

1. Which standardized report elements DOES NOT need to be optimally balanced?

a) Consistency versus Flexibility
b) Required versus Optional elements
c) Abbreviations versus Full terms
d) Completeness versus Conciseness

2. Which of the following phrases contribute most to the report?

a) Is noted
b) Unremarkable
c) Cannot be excluded
d) Within normal limits

3. Which of the following is correct?

a) Tautological phrases should be avoided
b) The past tense should be used
c) Measurements should always be written in the final report
d) Acoustic descriptions are enough on their own

4. Most referring physicians prefer the impressions/conclusions:

a) At the beginning of the final report
b) Written in capital letters
c) Are included
d) Orders items in the order they were visualized

5. Which is the best report-writing style?

a) Left Kidney: Kidney is enlarged and measures approximately 5.0 cm in length. There appears to be hydronephrosis, and perinephric fluid was also observed.
b) Left Kidney: The left kidney's size is abnormally large for this patient's age and gender. Significant hydronephrosis and perinephric fluid is seen. Stone cannot be excluded.
c) Left Kidney: Enlarged; 5-cm long. SFU grade 1 (mild) hydronephrosis. Perinephric fluid present.
d) Left Kidney: Looks concerning for hydronephrosis, and possible perinephric fluid is seen. Otherwise, kidney appears unremarkable but examination was difficult due to patient body habitus and poor cooperation.

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Use of Duplex Ultrasound Imaging Post-Endovascular Aneurysm Repair (EVAR): A Pictorial Review

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ABSTRACT

Individuals who undergo endovascular aneurysm repair (EVAR) require annual surveillance to detect endoleaks and guide surgical management. Endoleaks are classified into five categories based on the direction of blood flow in the aneurysmal sac outside the graft, determining prognosis and management. Currently, evaluation with computed tomography angiography (CTA) is favored as the gold standard for evaluation of endoleak. However, there is associated patient exposure to nephrotoxic intravenous contrast as well as radiation. Each of the five subtypes of endoleak can be characterized and subsequently followed on ultrasound. This practice offers a safe and cost-effective alternative to CTA.

Keywords: interventional radiology, EVAR, endoleak, ultrasound

Introduction

Abdominal aortic aneurysm (AAA) is defined as an enlargement of the abdominal aorta to bigger than 50% of its original diameter or more than 3 cm.[11] Owing to a significant risk of mortality associated with aneurysm rupture, patients are offered preventative treatment with a traditional open surgical repair of AAA or a minimally invasive endovascular approach using stentor synthetic grafts.[1,2] Individuals who undergo endovascular aneurysm repair (EVAR) require lifelong imaging for potential endoleaks and receive timely corrective treatment.

Endoleaks are classified into five categories based on the direction of blood flow outside the stented vessel lumen but within the aneurysmal sac.[11,14] This classification system also determines clinical consequences of the endoleak and resulting treatment.[9]

Definitions

Type 1 endoleak: It occurs if the leak originates from a point of attachment of the graft with the aortic wall.[11] This can be located proximally (Type 1A; Figure 1) or at a more distal aspect (Type 1B; Figure 2).[11]

Type 2 endoleak: It is the most common form of endoleak resulting from retrograde blood flow of the aortic branches into the aneurysmal sac (Figure 3).[3,11] This accounts for approximately 40% of endoleaks and usually involves the lumbar or inferior mesenteric arteries (Figure 4).[11] Type 2 endoleak can be further classified into Type 2A with a single causative vessel, and Type 2B, which tends to be more complex and includes multiple arteries.[11] Compared to other endoleaks, Type 2 endoleak often spontaneously resolves without requiring intervention.[3,11] However, it has been demonstrated that persistent Type 2 endoleak is associated with aneurysmal enlargement and possible rupture.[11]

Type 3 endoleak: Mechanical defect of graft components can lead to Type 3 endoleak under high pressure conditions, necessitating urgent treatment (Figure 5).[11]

Type 4 endoleak: It occurs transiently following EVAR secondary to porosity in the graft material (Figure 6). This subtype often requires no intervention and resolves following normalization of the coagulation cascade.[11,12]

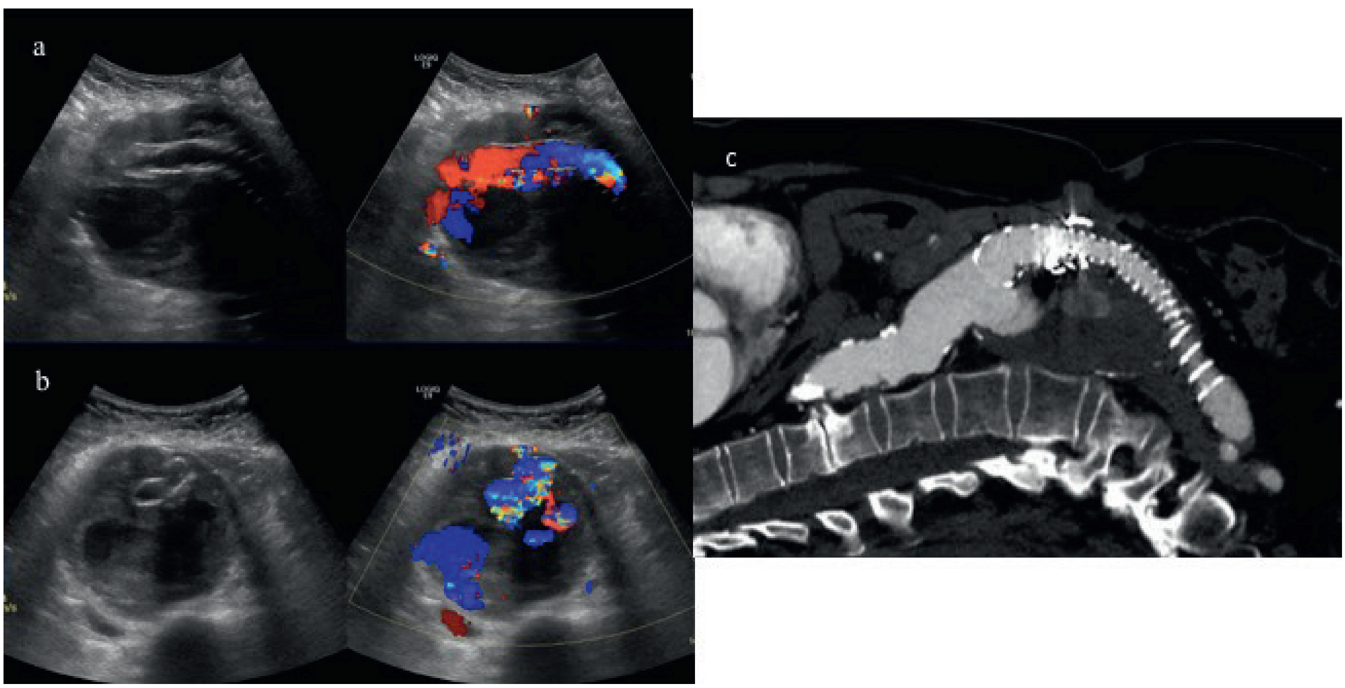

Figure 1. Type 1 A Endoleak. (a) Sagittal greyscale and Doppler sonograms demonstrate migration of the graft inferiorly within the native aneurysm sac. (b) Axial greyscale and Doppler sonograms demonstrate extensive heterogeneity and corresponding Doppler flow concerning for endoleak. (c) Corresponding sagittal CT image (oriented to match US) with contrast illustrates migration of the graft inferiorly and endoleak within the aneurysm sac.

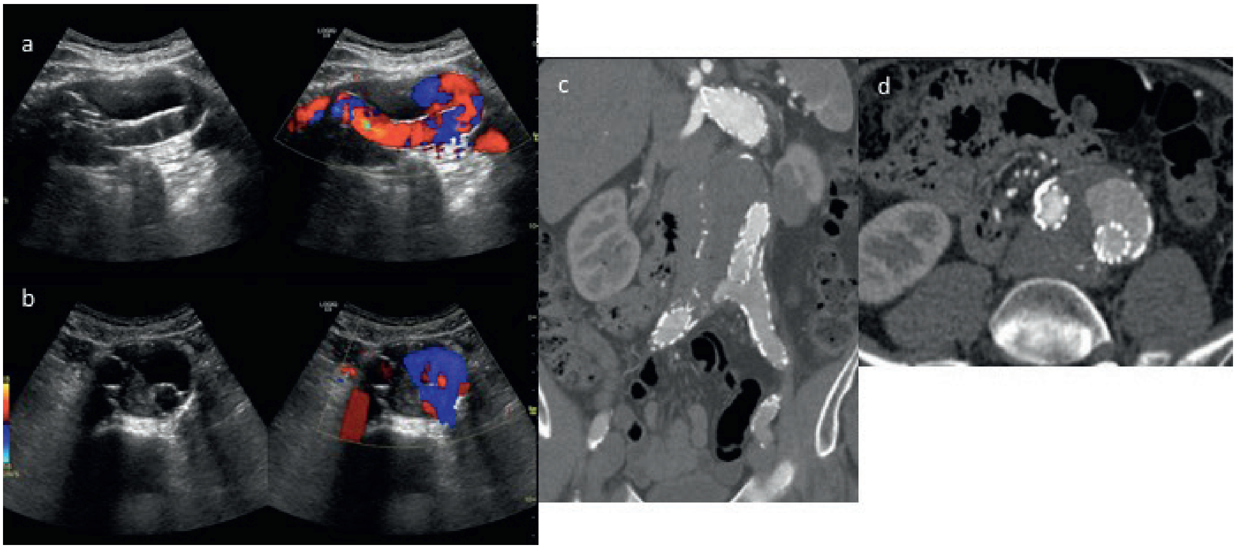

Figure 2. Type 1 B Endoleak. Sagittal (a) and axial (b) greyscale and Doppler images demonstrate Doppler flow outside of the graft toward the left side in the distal aorta. Coronal (c) and axial (d) CTA images demonstrate proximal migration of the left limb of the graft with endoleak filling from below into the aneurysm sac.

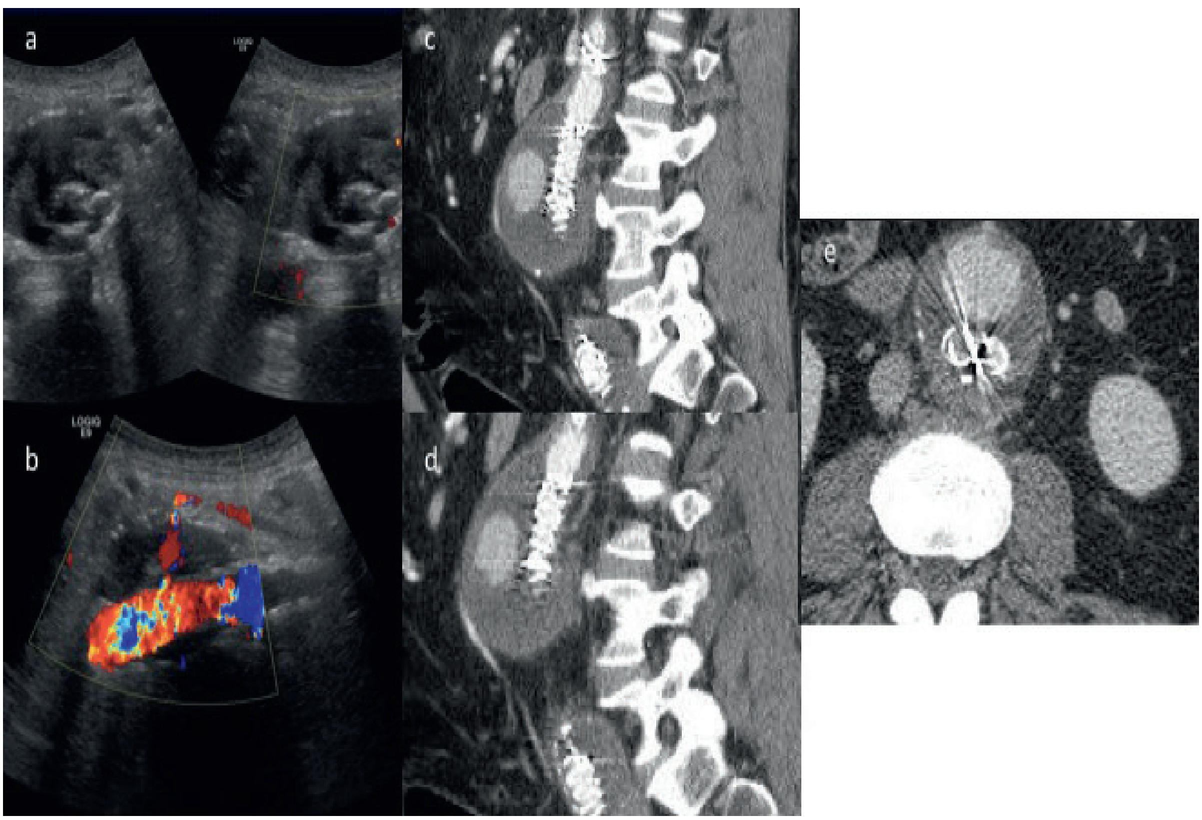

Figure 3. Type II IMA Endoleak. Axial (a) greyscale and sagittal (b) Doppler sonograms demonstrate extensive heterogeneity (concerning for endoleak) within the native aneurysmal sac anteriorly with Doppler flow at the native IMA origin. Sagittal (c,d) and axial (e) contrast CT demonstrate endoleak originating from the IMA.

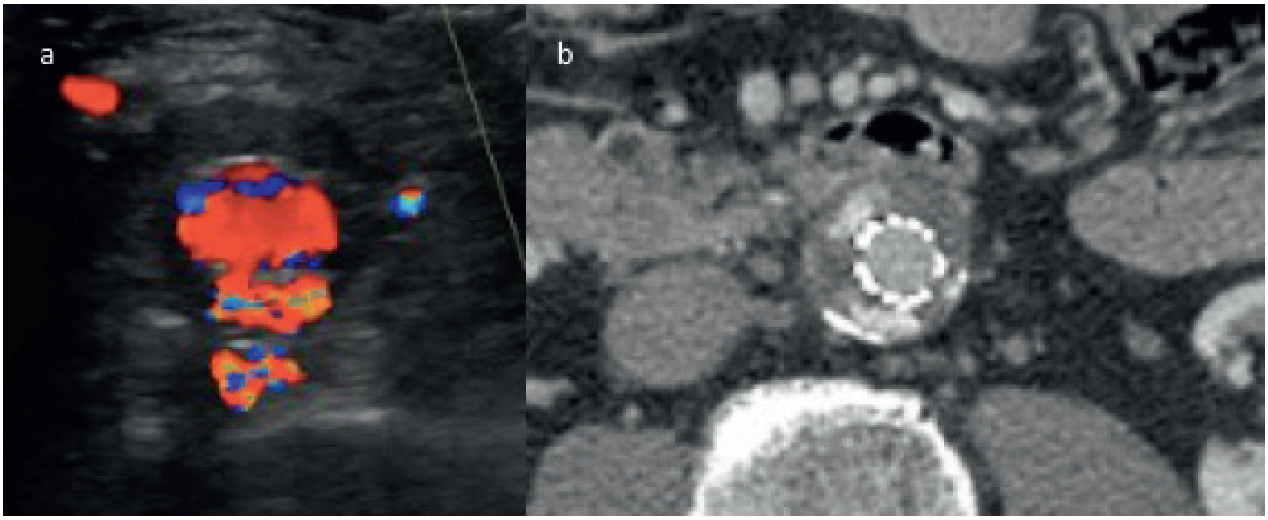

Figure 4. Type II Lumbar Endoleak. (a) Axial Doppler image demonstrates Doppler flow posteriorly within the sac from lumbar vessels. (b) Axial contrast enhanced CT confirms endoleak posteriorly within the sac from lumbar vessels.

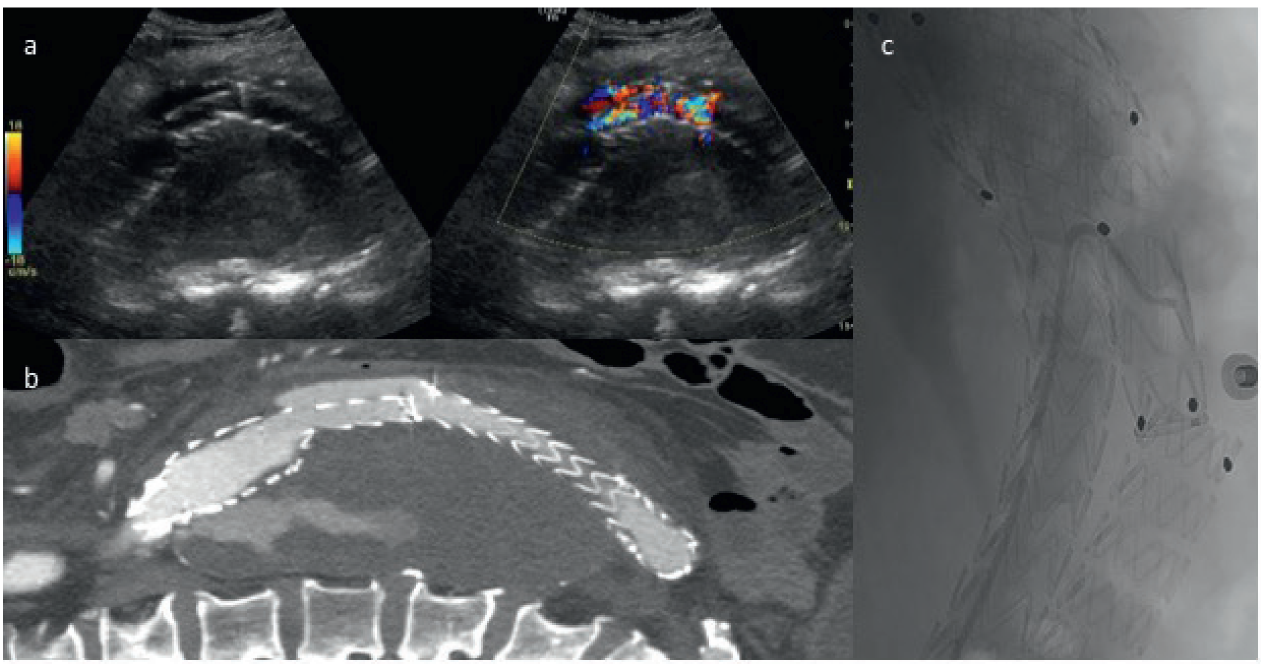

Figure 5. Type III Endoleak. (a) Sagittal greyscale and Doppler sonograms demonstrate flow outside the graft and discontinuity of the graft components. (b) Sagittal contrast enhanced CT (oriented to match US) demonstrate endoleak outside of the graft and confirms ultrasound findings. (c) Aortogram fluoroscopy image shows separation of the components of the endograft.

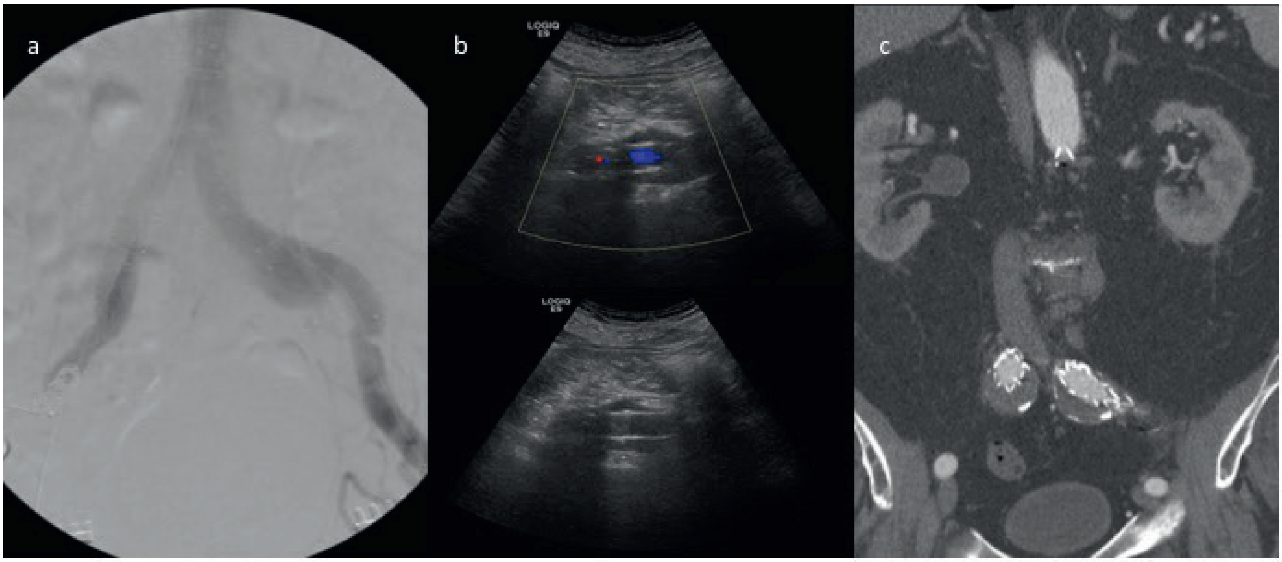

Figure 6. Type IV Endoleak. (a) Completion aortogram following EVAR for left common iliac artery aneurysm demonstrates slow delayed leak in the aneurysm sac. This was felt most likely related to porosity of the graft. (b) 6 week post EVAR. Sagittal greyscale & Doppler images of left common iliac artery illustrate resolution of the endoleak with no flow visualized outside the graft. (c) 3 month follow-up. Coronal CTA confirms the resolution of the Type 4 endoleak.

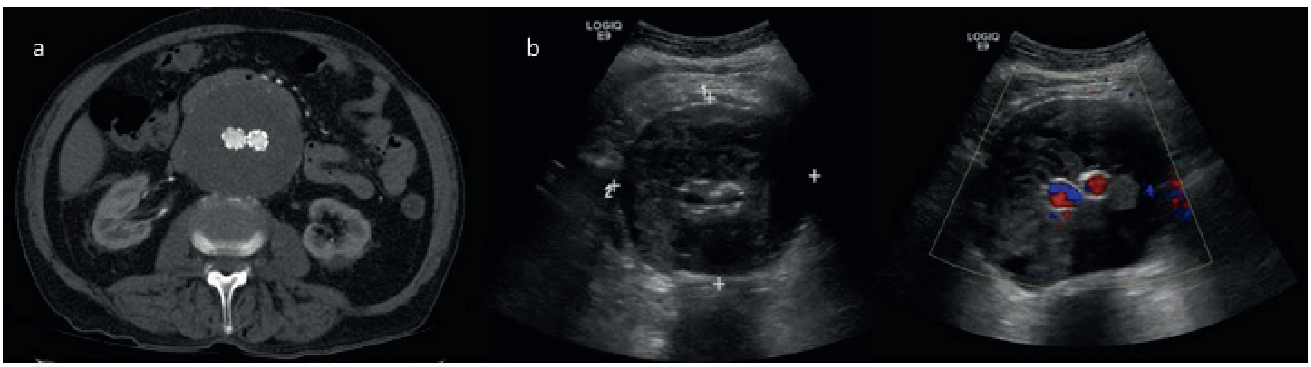

Figure 7. Type V Endoleak. (a) Axial CT image demonstrates endoleak repair with extension into the iliac vessels. The aneurysm sac is stable and measures up to 8.3 cm in maximal diameter with no evidence of endoleak. (b) One year follow-up ultrasound. Axial greyscale and Doppler sonograms demonstrate enlargement of aneurysm without evidence of endoleak. The aneurysm measures up to 9.1 cm which is increased from previous measurement of 8.3 cm on CT one year earlier. No source of bleeding was identified. This enlargement without evidence of overt source is in keeping with Type V classification.

Type 5 endoleak: Also called endotension, it is defined as the expansion of AAA without an identified endoleak (Figure 7).[11]

Discussion

While there is no standardized approach to monitor endoleak, current guidelines suggest a timeline of 1, 6, and 12 months post-EVAR followed by annual screening.[1,4,14] A CTA is currently viewed as the gold standard to monitor endoleak.[14] However, this practice exposes patients to nephrotoxic intravenous contrast as well as increased and cumulative doses of radiation.[6] Throughout a lifetime of screening, there is potential for altered renal function as well as malignancy.[6] Additionally, the use of CTA is associated with significantly increased cost and health care expenditure.[6] Ultrasonography offers a non-invasive and cost-effective alternative to CTA monitoring of endoleaks.[14] It is important to note that this modality is not without limitation, as the aorta may be difficult to visualize due to bowel gas or body habitus.[4] User dependence and increased time for examinations are additional inherent disadvantages of ultrasound.[4,7]

Studies have determined duplex ultrasound (DUS) as a safe and effective alternative to CTA imaging, citing ultrasound as the first line of screening tool following EVAR, providing significant cost savings and reduced radiation exposure.[7] In a recent study involving 920 patients who underwent EVAR for elective AAA repair, sensitivity and specificity of DUS in detecting endoleaks was 93.2% and 98.8%, respectively.[10] In this study, CTA and DUS were performed annually, with a less than 30-day interval between the imaging modalities for each patient.[10] Researchers were also able to determine a correlation between aneurysm sac measurement on CT and DUS with a Cohen's kappa (κ) coefficient of agreement of 0.91.[10] However, sensitivity and specificity for post-EVAR DUS is usually large, with multiple studies reporting sensitivity varying between 58% and 86%.[13] This variability is likely due to operator dependence, patient body habitus and the presence of bowel gas or hernia.[13]

In a retrospective review of DUS suitability as an initial and annual surveillance technique, Schaeffer et al. followed 266 patients for 3.2 years.[13] This method was deemed successful in detecting endoleaks with similar efficacy as CTA imaging and surveillance was achieved using DUS exclusively for 65% patients.[13]

Conclusion

This pictorial review provides images of each of the five subtypes of endoleak on DUS, illustrating the effectiveness of this imaging modality in screening for potential post-EVAR endoleaks. Corresponding ultrasound images using DUS were obtained for each patient to illustrate appearance of endoleak following detection of endoleak on CTA. Although the optimal method and approach to endoleak monitoring continues to cause debate, ultrasound monitoring has been determined to be an effective and safe initial surveillance option following uncomplicated EVAR. Visible endoleak or increasing sac size on DUS warrants CTA imaging to establish a possible treatment option.

In order to reduce risk of nephrotoxicity and radiation exposure, we hope to proceed with DUS as an initial test and long-term screening modality for post-EVAR surveillance at our center.

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Article Title: Use of Duplex Ultrasound Imaging Post-Endovascular Aneurysm Repair (EVAR): A Pictorial Review

Authors' Names: Ravindra Gullipalli, MD, FRCR; Angus Hartery, MD, FRCPC; Heather Martin, BSc (Hons.), MPH

1. **Which of the following is the least invasive procedure for preventative treatment of an abdominal aortic aneurysm (AAA)?**
   a) Angioplasty
   b) Arterial bypass graft
   c) Endovascular stent graft
   d) Open abdominal surgery

2. **Which of the following methods is currently the gold standard for surveillance of an aortic endograft (EVAR) for potential leaks?**
   a) Color doppler ultrasound
   b) Digital subtraction angiography
   c) Magnetic resonance angiography
   d) Computed tomography angiography

3. **Which of the following types of endoleak is attributed to reverse flow of small aorta branch arteries into the aneurysmal sac?**
   a) Type 1A
   b) Type 2
   c) Type 3
   d) Type 4

4. **In performing serial duplex ultrasounds for EVAR screening, which of the following findings is most suggestive of an endoleak?**
   a) Echogenic thrombus in aneurysmal sac
   b) Absence of flow in stent graft
   c) Enlargement of aneurysmal sac
   d) Pulsatile flow in stent graft

5. **During an ultrasound for EVAR surveillance, the contour of the stent graft demonstrates an irregular disruption of the components of the stent graft with flow into the sac. Which of the following types of endoleak is most likely to be assigned?**
   a) Type 2A
   b) Type 3
   c) Type 4
   d) Type 5

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Dandy–Walker Malformation

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ABSTRACT

Dandy–Walker Malformation (DWM) is a condition affecting the cerebellum. It consists of hypoplastic vermis, cystic enlargement of the fourth ventricle, and cystic formation near the posterior fossa. Ultrasound and magnetic resonance imaging scan are beneficial in inspecting these complications for both fetal and infantile cases. In this case series, fetal manifestations of DWM are explored through discussing maternal vitals, gestational age, clinical findings, and diagnostic imaging features (e.g., areas of encephalic enlargement and presentations of cystic dilation). It was observed that this condition is often mistaken for an arachnoid cyst, Blake's pouch cyst, Joubert anomaly, or Arnold–Chiari malformation. It is, therefore, essential to develop a framework with sufficiently conspicuous DWM imaging features and clinical manifestations to improve diagnostic accuracy.

Keywords: Dandy–Walker Malformation; Magnetic Resonance Imaging (MRI); neurology; ultrasound

Introduction

Dandy–Walker Malformation (DWM) is a congenital cerebellar defect affecting one in every 30,000 live births.[1] DWM is characterized by cystic dilation of the fourth ventricle and partial or complete absence of the cerebellar vermis because of hypoplasia.[1] Symptoms typically appear within first year of birth, although some patients remain asymptomatic until adult life.[2] Affected individuals clinically present with developmental anomalies such as motor difficulties, progressive hydrocephalus, and commonly exhibit seizures.[1,3,4] Cases of DWM appear sporadically with no specific inheritance patterns.[5] The etiology of DWM is currently unclear, although there are some suspected etiological factors such as chromosomal abnormalities, genetic mutations, Mendelian disorders, congenital infections, and fetal exposure to teratogens.[5–8]

Case Descriptions

Patient 1

The following patient was a 41-year-old female (G6P4) with 22-week pregnancy. She presented with normal vital signs, blood pressure of 128/92 mmHg, no clinically significant comorbidities, and no vaginal bleeding or discharge. The fetus was assessed, and the fundal height matched the gestational age of 22 weeks. Using a GE LOGIQ E9 ultrasound machine, examination revealed a triangular defect toward the posterior aspect of the fetal brain. The lateral ventricles appeared to be normal in size. The fetus exhibited hypoplasia of the cerebellar vermis, with an enlarged cisterna magna (Figure 1). Differential diagnoses included an arachnoid cyst, Blake's pouch cyst, Arnold–Chiari malformation, and the most likely diagnosis was determined as DWM.

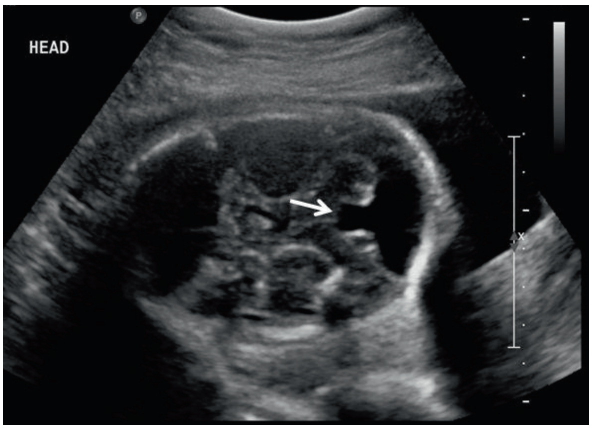

Figure 1. Ultrasound at 22 weeks demonstrates hypoplasia of the cerebellar vermis and dilation of the cisterna magna.

Patient 2

A 40-year-old primigravida female, 35 weeks 3 days pregnant, was referred from a primary health centre (PHC) with an abnormal ultrasound report. A third-trimester obstetric ultrasound was performed at a specialized center, and the findings are depicted in Figure 2. The fetal biparietal diameter was above the 95th percentile because of probable ventricular dilatation. A follow-up fetal magnetic resonance imaging (MRI) scan was also done, which depicted a large posterior fossa cyst with normal superior vermis and an absent inferior vermis (Figure 3). Physical examination revealed normal systemic findings. The obstetric-abdominal examination revealed a soft, lax, non-tender abdomen with fundal height corresponding with the gestational age. The presentation was cephalic with an appreciable fetal heart rate.

Patient 3

This patient was a 26-year-old primigravida with a fetal gestational age of 33 weeks 3 days. Prenatal ultrasound demonstrated a single live fetus in cephalic presentation with evidence of a dilated third ventricle presumably communicating with the fourth ventricle (Figure 4). The amount of

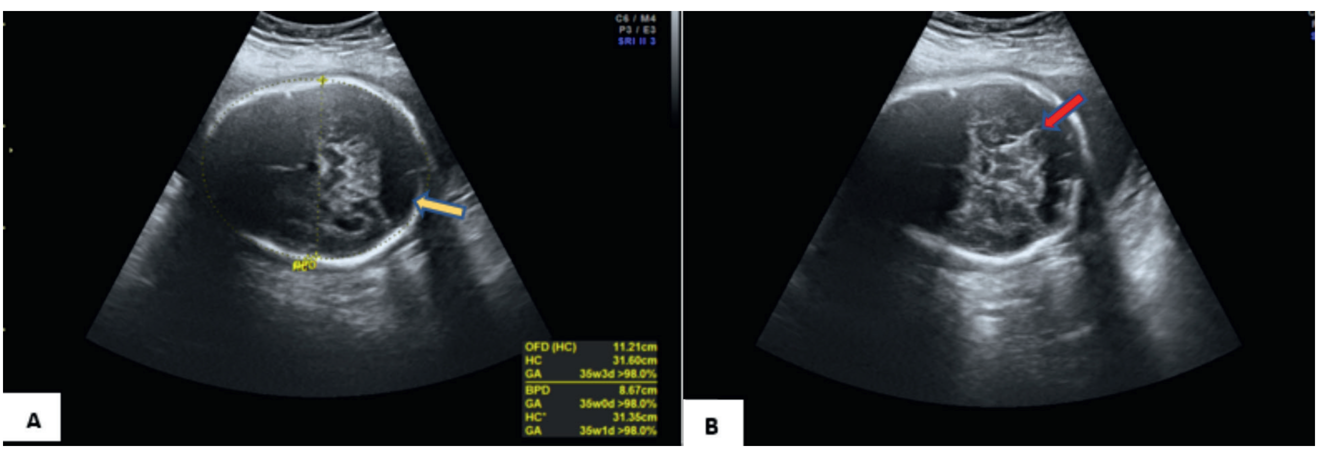

Figure 2. (A) Obstetric ultrasound at 35 weeks 3 days presenting large posterior fossa cyst (yellow arrow), and (B) cerebellar hypoplasia (pink arrow), which is not evident due to a shadowing artifact.

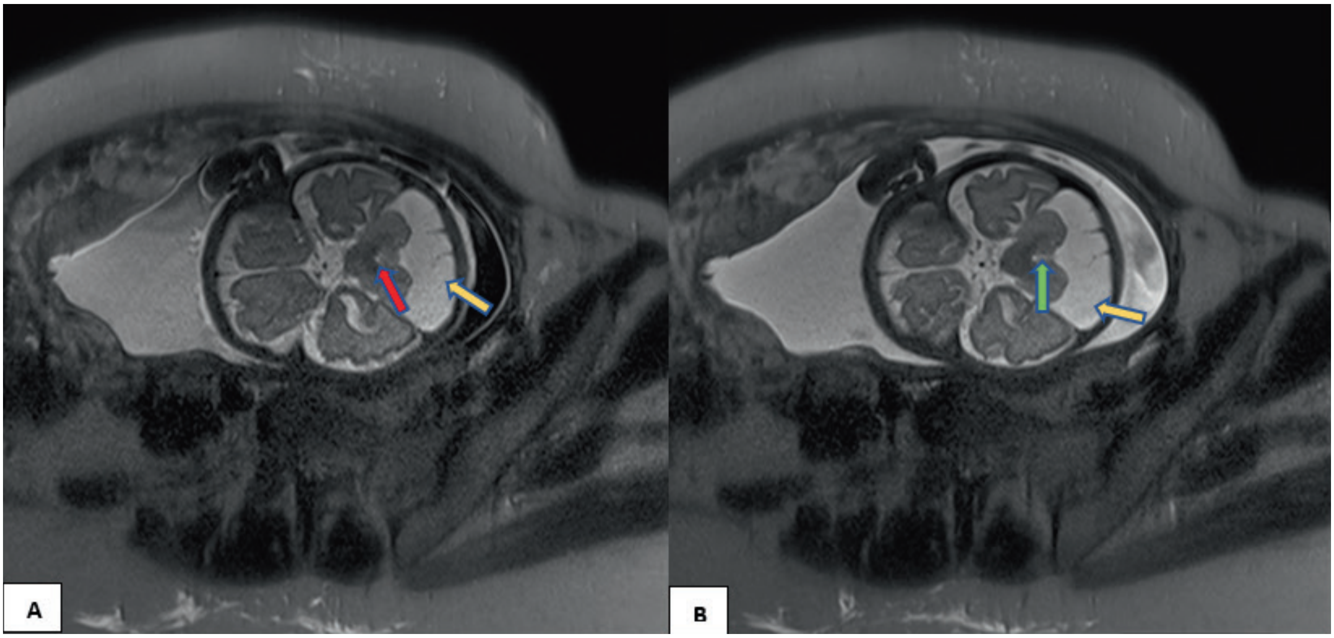

Figure 3. A T2-weighted fetal MRI (axial sections) presents (A) presence of superior vermis (pink arrow), and (B) absent inferior vermis (green arrow) with a large posterior fossa cyst (yellow arrows).

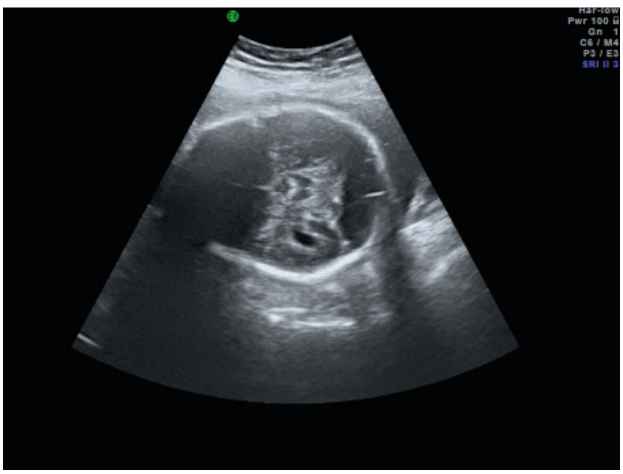

Figure 4. Prenatal axial ultrasound image depicting a single live fetus with an enlarged retro-cerebellar cerebrospinal fluid (CSF) space.

amniotic fluid was adequate with an Amniotic Fluid Index (AFI) of 15.9 cm with an anterior fundal placenta. The monitored fetal heart rate was 137 bpm, regular in rhythm, with normal fetal movements. The fetal bi-parietal diameter (BPD) and head circumference (HC) corresponded to a gestational age of 35 weeks.

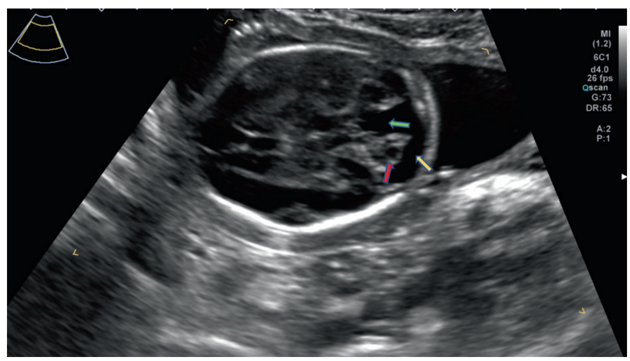

Figure 5. Third-trimester scan presenting hypoplastic cerebellum (red arrow), agenesis of the vermis (green arrow), and posterior fossa dilation (yellow arrow).

Patient 4

A 27-year-old (G4P2) with a 33-week 2-day gestation had a consanguineous marriage with her first cousin. The patient had a poor obstetric history with a previous neonatal death with no known cause. Ultrasound scans of the fetal brain demonstrated normal brainstem and spinal canal. However, the fetal brain depicted cerebellar vermis agenesis with mild hypoplasia of the cerebellar hemisphere and

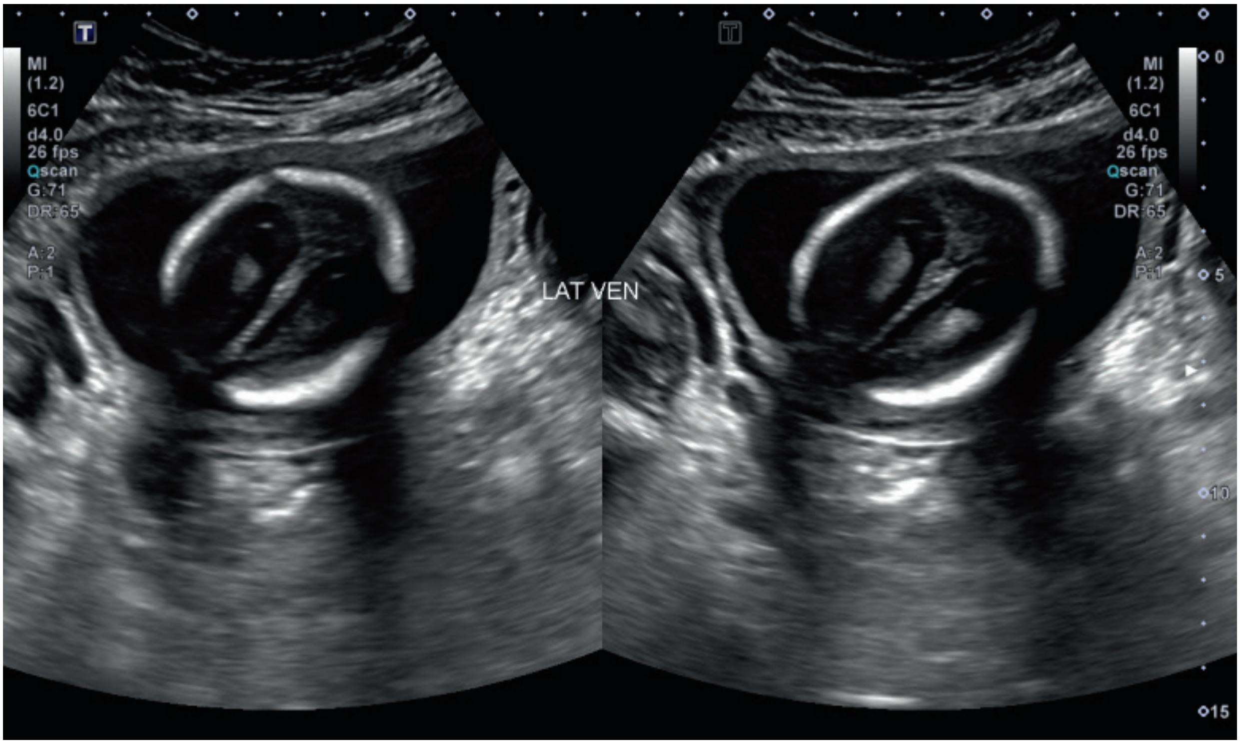

Figure 6. Axial ultrasound image of the fetal brain presenting mild ventriculomegaly in the lateral ventricles.

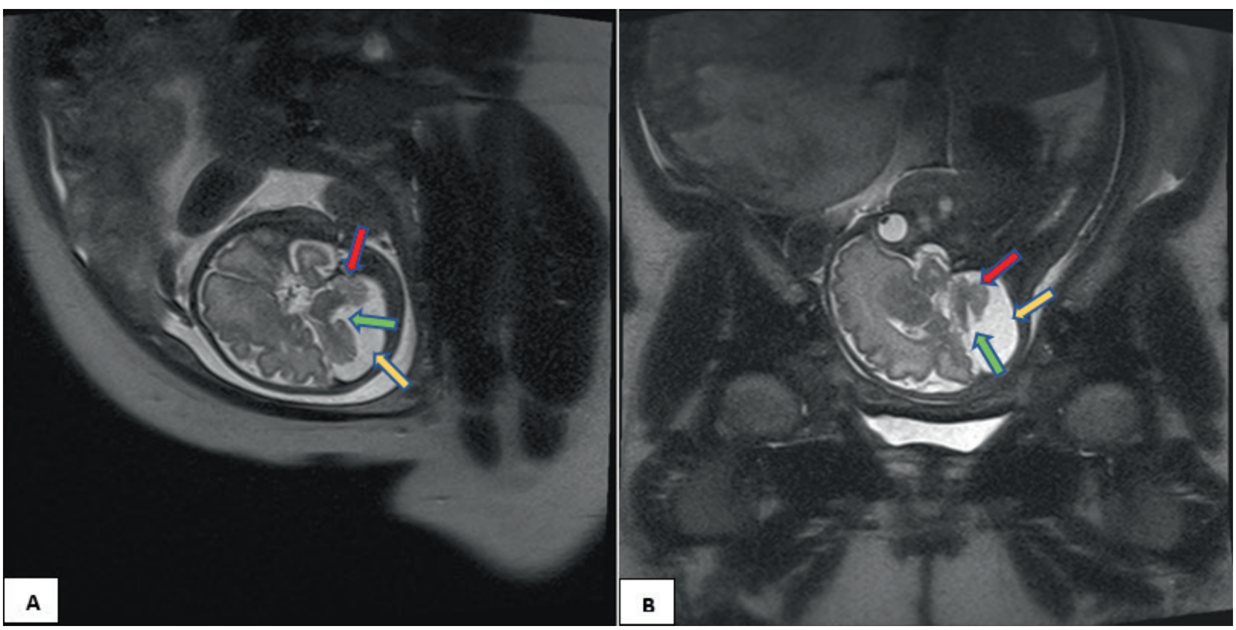

Figure 7. Fetal MRI of T2-weighted half-Fourier acquisition single-shot turbo spin-echo (HASTE) sequence (A) axial, and (B) sagittal presenting absent vermis (green arrows), hypoplastic cerebellum (pink arrows), and posterior fossa dilation (yellow arrows).

a large dilation in the posterior fossa connected to the fourth ventricle (Figure 5 and 6). MRI scans of the fetal brain supported the ultrasound findings indicating cerebellar vermis aplasia, hypoplastic cerebellum, and posterior fossa dilation (Figure 7). These features most likely represent DWM.

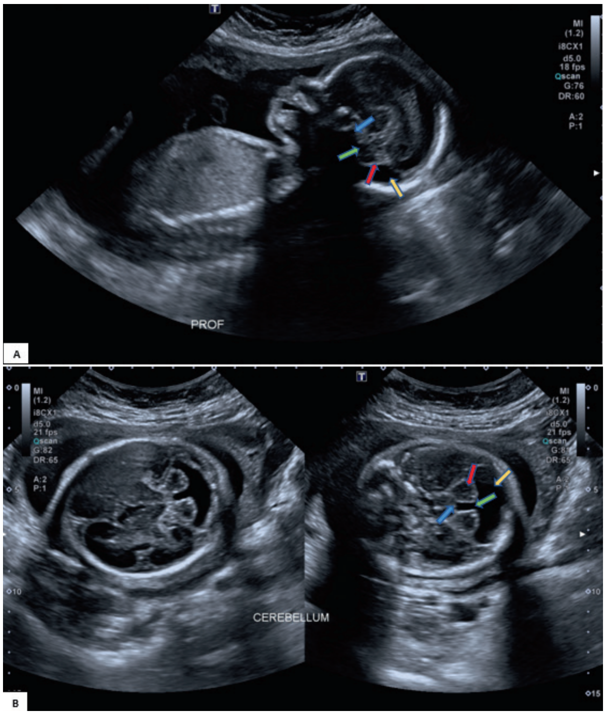

Figure 8. Obstetric 3rd-trimester ultrasound: (A) sagittal and (B) axial views presenting the posterior fossa cyst (yellow arrow) communicating with the fourth ventricle (blue arrow). The cerebellum is hypoplastic (pink arrow), and the cerebellar vermis is absent (green arrow).

Patient 5

A 34-year-old mother (G4P1A2) with a history of familial hypercholesterolemia had a single viable fetus (26+ weeks), with an estimated fetal weight (EFW) of 901 ± 135 g. Ultrasound revealed absence of the cerebellar vermis and dilation of the cerebral lateral ventricles and third ventricle, with the right lateral cerebral ventricle measuring 8–11 mm (Figure 8). Splaying of the cerebellar hemispheres, mild ventriculomegaly, and enlarged posterior fossa are the features consistent with DWM.

Patient 6

A 33-year-old, G2P1 female at 33-week 5-day gestation was brought by an ambulance with painless vaginal bleeding. Around 50 mL of blood clot was removed during pelvic examination. This patient also had a history of gestational diabetes and of a uterine fibroid in the anterior lower uterine segment. Ultrasound of the fetal brain exhibited a hypoechoic lesion measuring 3.7 × 3.2 cm in the posterior fossa. The reporting radiologist noted that it might represent dilatation of the fourth ventricle, suggestive of a DWM variant (Figure 9).

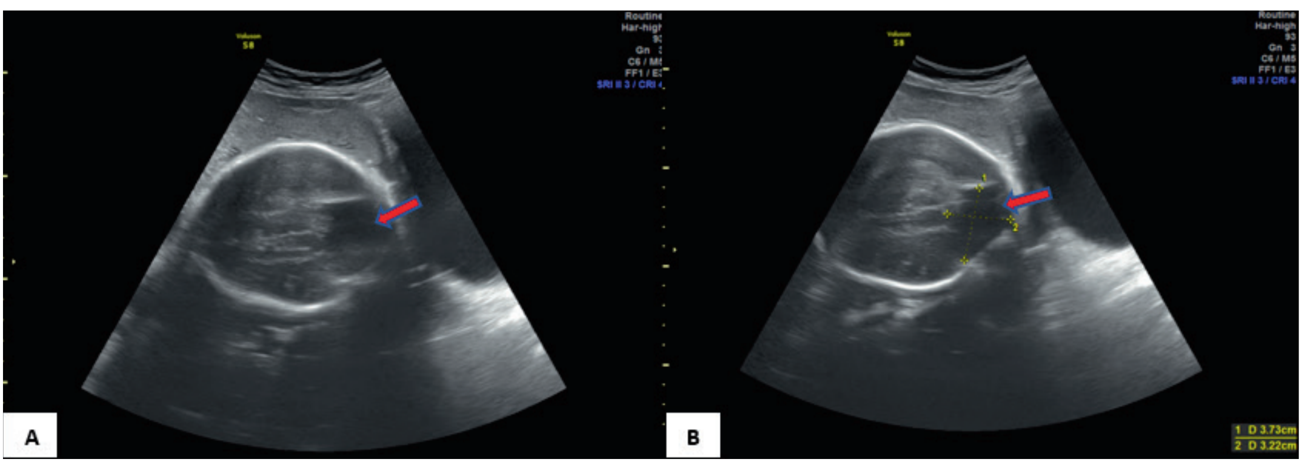

Figure 9. (A) Obstetric third-trimester ultrasound, and (B) presenting cystic dilatation of the fourth ventricle (pink arrows).

Patient 7

A 25-year-old G3P2 female presented at 35 weeks & 3 days with a live single fetus in cephalic presentation with an EFW of 2564 ± 375 g. The AFI was measured as 9.8 cm. The fetus exhibited dilation of the fourth ventricle, suggestive of DWM, with mild dilation of the lateral ventricles (Figure 10). The fetal posterior cranial fossa demonstrated a cystic structure measuring 4.4 × 2.3 cm that depicted no obvious connection to the ventricular system, indicating a probable posterior fossa arachnoid cyst (Figure 11). No other fetal anomalies were detected during the examination.

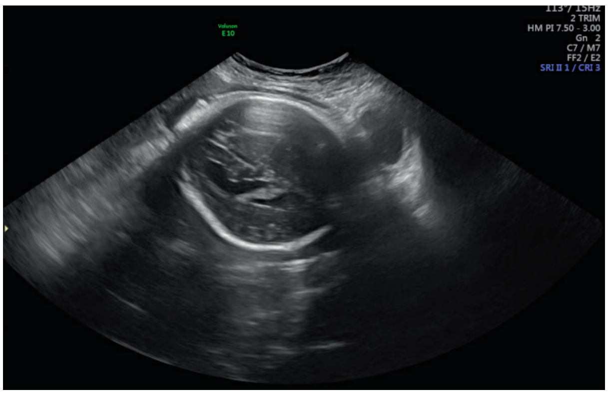

Figure 10. Signs of mild ventriculomegaly are seen in the lateral ventricles. This axial image also qualitatively presents an enlarged head.

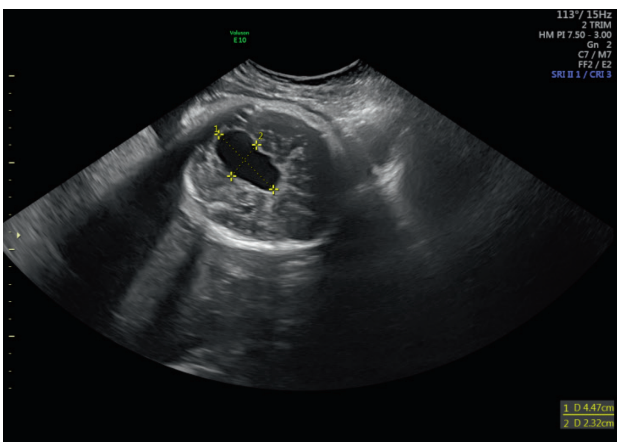

Figure 11. An arachnoid cyst may manifest in conjunction with DWM, making diagnosis more challenging. The arachnoid cyst measures 4.4 × 2.3 cm with no communication to the ventricles.

Discussion

In 1914, Dandy and Blackfan provided a framework for DWM pathophysiology, etiology, and relevant manifestations.[9] Current studies revealed a continuum of posterior fossa cystic malformations.[9] The subtypes fall under the category of Dandy–Walker Complex (DWC).

Dandy–Walker Malformation is an early embryonic finding with impairments in cerebellum formation and surrounding structures.[10] It can be related to mutations in *3q24.3*, *6p25*, or *13q32.2-q33.2* loci, or chromosomal aberrations such as a duplication of *9p*, or *trisomy 18*.[10,11] Geriatric pregnancies (aged >35 years) can also be implicated with an increased risk of such genetic abnormalities, as evidenced by the advanced maternal age in case of Patients 1 and 2.[12] Similarly, the obstetric history of Patient 1 (with five previous pregnancies) may have influenced DWM genesis through the potential correlation of grand multiparity and risk of congenital defects. Rarely, DWM can also be associated with abnormalities such as congenital heart defects.[11] Among the above-mentioned patients, two had a maternal history of cardiovascular risk factors: Patient 5 with familial hypercholesterolemia, and Patient 6 with gestational diabetes mellitus. This may allude to a possible interplay between cardiovascular disease and DWM pathogenesis.

Dandy–Walker Malformation manifestations tend to be isolated, and are therefore ambiguous in terms of etiology.[11] Recent evidence points toward abnormalities in the development of the rhombencephalon roof as an influence.[5] Autosomal recessive and X-linked inheritance patterns are additional possibilities based on reports that demonstrated the isolated presence of DWM in siblings.[9] Patient 4 exemplifies this theory as an outcome of consanguineous marriage, increasing the prospect of autosomal recessive disorders.[14] Overall, there can be complex genetic components responsible along with possible environmental factors like teratogens.[11]

Patients of DWM typically present with hypoplasia of the cerebellum and vermis, as indicated in most cases.[11] Ultrasound images of Patient 5 revealed vermian aplasia as well as a connection between the fourth ventricle and posterior fossa.[11] An enlarged fluid-filled cavity between these areas is a common finding in DWM patients, resulting in macrocephaly and hydrocephalus.[10] Poor postnatal neurological sequelae, such as impaired higher motor functions, intellect, and even cognition, may also follow due to these pathological changes.[11]

Treatment of DWM includes managing both symptoms and comorbidities.[5] Since hydrocephalus is a common complication of this condition; the focus should be directed to relieving intracranial pressure through surgical intervention, such as ventriculoperitoneal (VP) or cystoperitoneal shunts.[5] Most of the patients described in this case series went on to have special education and physical therapy to manage the associated neurological dysfunction.[10]

There can be four primary differential diagnoses to all above-discussed cases: Arachnoid cyst, Blake's pouch cyst, Joubert anomaly, and Arnold–Chiari malformation. In most cases, arachnoid cysts can be ruled out because severe cerebellar and vermian hypoplasia are not consistent with an arachnoid cyst.[9] Patient 7 was the only case suspected of having both posterior fossa arachnoid cyst and DWM. This demonstrates that it is possible for two differential diagnoses to appear simultaneously in one patient. A Blake's pouch cyst is an unlikely diagnosis for all presented cases as this condition typically manifests with a compressed and elevated cerebellar vermis that may be confused with vermian hypoplasia.[9] Furthermore, this is commonly seen later in life and is thus less likely to appear in utero.[9] The Arnold–Chiari malformation is also an unlikely diagnosis because the cisterna magna and fourth ventricle were dilated in most patients, and there were no signs of a banana-shaped cerebellum.[9] Joubert anomaly is an autosomal recessive condition that can present with variable degrees of vermian cerebellar hypoplasia but rarely with ventriculomegaly.[9]

Although ultrasound is the principal screening tool for prenatal assessment, MRI has a superior spatial resolution and thus is able to delineate DWM more accurately. 2-dimensional (2D) ultrasound was found to have a sensitivity of 72.2%, while MRI has a value of 88.9% in Central Nervous System imaging.[15] This indicated that both modalities are able to detect brain anomalies reliably. However, the frequency of true positives is greater with the use of MRI. Meanwhile, the specificity of ultrasound (100%) signifies a complete exemption from false positives.[15]

Diagnosis of DWM usually occurs a year after birth but could be delayed until adulthood.[9] This case series analyzes the use of fetal ultrasound and MRI to improve the diagnostic and prognostic outcomes of DWM, thereby providing families more time to prepare for associated complications. It can be challenging to render an accurate diagnosis with seemingly multiple identical conditions; therefore, this case series could serve as a primer for medical personnel in the diagnosis of posterior fossa anomalies.

Conclusion

Dandy–Walker Malformation is a rare congenital defect that results in cystic dilation of the fourth ventricle and hypoplasia of the cerebellar vermis, accompanied by hydrocephalus.[1,4] Diagnosis occurs primarily through ultrasound in conjunction with clinical findings.[4] Differential diagnoses such as arachnoid cyst, Blake's pouch cyst, Joubert anomaly, and Arnold–Chiari malformation could be challenging to distinguish from DWM, necessitating further imaging or genetic testing referrals.[4,5] A combination of differential diagnoses may be present, and MRI can be utilized to settle more sophisticated and ambivalent cases.

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CJMS Article: Sonography Canada CPD Credit

Article Title: Dandy–Walker Malformation: A Multi-Site Case Series

Author's Name: Mohamed Nashnoush, BHSc, CRGS in progress

1. **Which of the following is NOT an essential feature of Dandy–Walker Malformation?**
   a) Complete or partial agenesis of the vermis
   b) Cystic dilation of the fourth ventricle extending posteriorly
   c) Malformation of the brainstem
   d) Enlargement of the posterior fossa with torcular-lambdoid inversion

2. **Which of the following conditions is NOT a differential diagnosis of DWM?**
   a) Central Pontine Myelinosis
   b) Blake's pouch cyst
   c) Mega cisterna magna
   d) Posterior fossa arachnoid cyst
   e) Joubert anomaly (vermian hypoplasia)

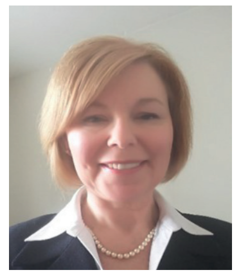
3. **The estimated prevalence of DWM is about 1 in ___________ live births.**
   a) 1000
   b) 10,000
   c) 30,000
   d) 50,000
   e) 100,000

4. **Which of the following is NOT a common sign/symptom of DMW?**
   a) Poor coordination and balance (ataxia)
   b) Developmental delay
   c) Increased intracranial pressure and enlarged head circumference
   d) Nausea and vomiting
   e) Intellectual disability

5. **Which of the following genetic mutations is most often associated with DMW?**
   a) Trisomy 21
   b) F508del CFTR mutation
   c) Trisomy 18
   d) Deletion of chromosome 5p
   e) Isochromosome 12p

Sonography Canada: Growing as a Professional Association

By Susan Clarke, Executive Director, Sonography Canada



As the professionalization of diagnostic medical sonographers (DMS) evolves, Sonography Canada has re-focused its strategies and activities to achieve its mission as the national voice of sonographers in Canada. Unlike regulatory bodies with whom professionals must register to be legally authorized to practice and where protecting the public interest is the main priority, our association is focused on ensuring a robust credentialing process, promoting the profession, and representing and supporting the needs and interests of its members. With this in mind, Sonography Canada's strategic plan 2020-2022 included a goal to "review and re-structure the organization to be member-driven, innovative, responsive, and streamlined."[1]

Much thought was given to how Sonography Canada could support DMS through all stages of their career, from the time they become a student, enter the profession, and eventually retire. It meant taking a hard look at what is true 'core' for the organization.

Sonography is subject to the underlying healthcare trends, pandemic pressures, funding pressures, evolving practice, changing technology, and the shifting and overlapping scopes of practice among healthcare professionals. "The efficiency and effectiveness of our association depends on our ability to adapt and respond to the demands of our profession, and on our capacity to adopt and maximize new technologies and resources."[2] As a result, Sonography Canada's leadership team has grown in size and expertise and is structured to ensure it addresses and supports its core functions: **credentialing, continuing professional development, member support and promoting the profession**.

Sonography Canada has been and continues to be the official credentialing body for sonographers in Canada. Provincial regulators and many healthcare facilities across the country require successfully completing our entry-to-practice certification exams and credentials to practice sonography. Accreditation Canada recognizes our national competency profiles and professional practice guidelines as the standards to meet Canadian sonography education programs. An important role of the Manager, Certification is to build, maintain and enhance Sonography Canada's relationships with the regulatory

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1 Sonography Canada Strategic Plan 2020-2022 (https://sonographycanada.ca/app/uploads/2020/07/Sonography-Canada-Strategic-Plan-2020-2022.pdf)

2 Ibid.

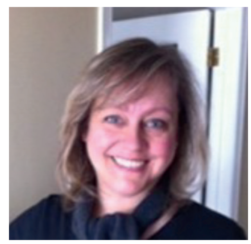
and accrediting bodies as well as educational institutions to ensure we promote standardization in educational and certification practices to meet the ever-growing demand for sonographers, and provide access to additional certification thereby recognizing the specialized areas of expertise within the profession itself (e.g. musculoskeletal, breast, etc.).

Jan Gilby, DMS – Manager – Certification

***Credentials are the gateway into the profession**. I was part of the team who initially created Canada's sonography exams. It was important that these exams fit the Canadian context. I have taught students and I have a unique perspective on national entry-to-practice exams and competency profiles thanks to my time with Accreditation Canada. Returning to Sonography Canada is like coming home. I am privileged to be able to contribute to our association's efforts to create valid and reliable exams that support the evolution and growth of the profession.*

While **earning credentials** is mandatory to practice sonography in most parts of the country, the requirement to **maintain credentials** may vary. Continuing Professional Development (CPD) is how sonographers sustain and continue to develop skills and competencies as professionals. CPD isn't just a means of maintaining credentials and meeting regulatory CPD requirements – it helps sonographers gain new perspectives, stay current with new methods and guidelines, and leads to new opportunities. Recording CPD activities is a way to reflect on learning goals, and the Sonography Canada CPD triennium helps members meet these targets.

Audrey McNeill – Manager – Continuing Professional Development



***CPD is the gateway to new opportunities**. It ensures that professional practice is in line with patient safety and clinical standards and promotes trends and innovation to help sonographers evolve and grow throughout their career. We want to keep them interested and motivated to expand their skills and broaden their scope of practice. As they acquire knowledge and experience, we want to encourage them to share that with their peers and serve as mentors for the next generation of sonographers.*

Sonography Canada and education partners offer a balance of sonography-based and relevant-to-practice learning opportunities and events reviewed and accredited for sonographers. Sonography Canada has grown. The membership has grown. The video library has grown. The demand for various methods of delivery has grown. As a result, the Sonography Canada leadership team has grown and now includes a manager dedicated to expanding our members' breadth and depth of CPD opportunities.

The team also includes a Manager, Professional Practice whose scope goes beyond CPD to address the unique situations, issues, and concerns sonographers face daily with patients, colleagues, managers, and fellow healthcare professionals. Your association is where you go for insight and guidance on practice guidelines, policy statements, and liability issues.

Tara Chegwin – Manager – Professional Practice

***Sonography is a relatively new profession**, having only been used for medical purposes since the mid-1950s. As a result, we are still defining and establishing our place within the healthcare system. Ultrasound is unique due to its rapidly advancing technology and scope as well as extensive patient interactions. Regulators do not look at practice trends. They are focused on enforcing standards to ensure patient safety. We are focused on national practice and enhancing the patient and sonographer experience. When faced with challenging situations, Sonography Canada is where members go with the question "Are sonographers doing this?"*

It's no accident that Sonography Canada is described as "the national voice" for DMS in Canada. It is the only national association entirely devoted to the profession of sonography and is, therefore, the national authority on sonography competencies, standards, and protocols in Canada. We speak to sonographers across Canada about initiatives, issues, and opportunities within the association and the industry. We also speak on behalf of sonographers across the country to defend their needs, interests, and rights with employers, manufacturers, educational institutions, governments, and fellow healthcare professionals.

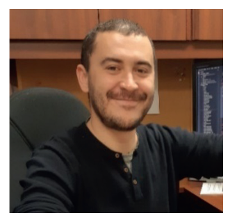
But promoting the profession goes well beyond advocacy. It also means attracting Canadians to a career in ultrasound. It means ensuring that sonography is acknowledged as a distinct profession playing an essential role in support of various other medical occupations in Canada's healthcare system. It also means promoting excellence in the practice of sonography across the country. All this involves substantial membership, marketing, and communications efforts which, in turn, required a full-time manager focused on these functions.

Meagan Rockett – Manager – Membership, Marketing & Communications

Promoting the profession is about growth. *I am delighted to have the opportunity to bring my decade of membership and marketing experience to Sonography Canada. Working alongside my colleagues, I aim to expand the association's membership reach across the country, the level of engagement they have within the organization, and the benefits they enjoy as members. My goal is to ensure all relevant parties are aware of the association's many initiatives to help enhance the sonographer's experience and ease their professional journey as they transition through the various phases of their career.*

Sonography Canada's strategic plan also entails many functional improvements involving automation, Web development, and new technologies. While this work may take place behind the scenes, it is now also front and center during leadership team discussions. Having a Manager, Web Development, and Administration at the table helps ensure that the 'ideas' being generated can realistically and practically be implemented and maintained by the association.

Riad Kadi – Manager – Web Development and Administration



We need to adapt with the times so that we are not left behind*. This means adapting to social changes as well as evolving technology. My job is to build the 'machine' and keep the gears greased so that Sonography Canada's technical infrastructure is solid and runs well, thereby allowing my colleagues to deliver on their commitment to members.*

A strategic plan is important, but implementing it and sustaining the momentum is what really matters. Assembling this new leadership team was not only about actioning an item in this plan but also about gathering the right people with the right expertise to help move things forward. Ultimately, it is an important reflection of Sonography Canada's evolution as a 'professional association.'