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# AMSj

Amsterdam  
Medical  
Student  
journal

**THOMAS MEULENDIJKS** |  
RESEARCH ABROAD: MASTER  
THESIS AT THE HOSPITAL OF  
SICK CHILDREN IN TORONTO

**SUBJECT 101 - PHARMACOLOGY** |  
RYEQO: ANOTHER APPROACH TO  
ENDOMETRIOSIS-RELATED PAIN

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## Editorial

Dear readership,

On behalf of the editorial board, I would like to welcome you to this new edition of AMSj. As we approach the end of another academic year, this edition reflects the dedication, curiosity, and perseverance that continue to define our reviewers. To all our authors, staff reviewers, editors, and General Board members: thank you for your commitment and hard work throughout this academic year. We couldn't have done it without you.

This edition includes inspiring international perspectives. In "Research Abroad", Thomas Meulendijks shares his experience conducting pediatric oncology research at SickKids Hospital in Toronto, offering insight into both the scientific and personal challenges of pursuing research abroad. In "From Promise to Practice: What It Takes to Implement AI in Healthcare" by Sara Ben Hmido, readers are taken beyond the hype surrounding artificial intelligence and introduced to the real-world challenges of integrating AI safely and effectively into modern healthcare systems. What does it truly take before AI can become part of daily clinical practice?

Surgical enthusiasts can look forward to "Changing Perspectives in Plastic Surgery", an article exploring the evolving role of indocyanine green in assessing tissue perfusion intraoperatively during surgical procedures. In addition, students who are interested in trauma and military surgery can read about Artin Akchi Masjediy's experienc-

es and insights regarding blunt traumatic aortic injury, offering a closer look into one of the most severe and challenging conditions encountered in trauma care.

On the more clinical side, Danique van der Sman and Prof. Dr. A. Thijs explore the role of procalcitonin in diagnosing bacterial infections and guiding antibiotic treatment in "Subject 101: Laboratory Tests". In the "Radiology Quiz", Maartje C. Montauban van Swijndregt, Matthijs J. van Ee, and Prof. Dr. Mario Maas challenge readers with an acute stroke case, guiding them through CT imaging, perfusion scans, thrombectomy, and the rare carotid web.

Furthermore, Hannah van der Giessen and I reviewed the Pocket Ouderengeneeskunde recently released by Compendium Geneeskunde, a helpful practical guide for students during their Geriatric internship.

Finally, we sincerely hope these articles will spark curiosity, broaden perspectives, and inspire readers throughout the final stretch of the academic year. Take a moment to reflect on everything you have achieved so far and enjoy the 40th edition of AMSj.

Sincere greetings,

*Yassmina Derraze*  
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**Amsterdam UMC,**  
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# WHAT'S NEW

## Updated 5-year outcomes of transcatheter versus surgical aortic valve replacement in patients with severe aortic stenosis at low- to intermediate-surgical risk

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Transcatheter aortic valve implantation (TAVI) has rapidly expanded from a treatment for inoperable patients to a widely used alternative to surgical aortic valve replacement (SAVR), even in younger and lower-risk populations. However, new 5-year data challenges the assumption that both strategies yield comparable long-term outcomes.

A pooled analysis of six randomized controlled trials including 7249 patients with severe aortic stenoses demonstrates that TAVI is associated with higher long-term mortality compared to its surgical counterpart. At 5 years, mortality reached 29.7% after TAVI versus 27.6% after SAVR. In addition, there

was a trend towards higher stroke rates in the TAVI group (posterior probability of 88.0% that SAVR is superior), as well as worse combined outcomes of death and stroke (posterior probability of 99.5% in favor of SAVR). Early advantages of TAVI diminish over time, with survival curves crossing after approximately 3-4 years.

These findings are clinically relevant, as TAVI is increasingly offered to patients with a longer life expectancy. Potential explanations for worse long-term outcomes include valvular degeneration, paravalvular leakage, and thromboembolic complications such as subclinical leaflet thrombosis. While these risks may be less impactful in older or more frail patients, they become increasingly important in younger populations. Despite the minimally invasive nature and strong short-term outcomes, TAVI should be applied with caution in low risk patients, since SAVR may still provide more durable results and better survival in patients expected to live beyond 5 years.

1. Marin-Cuartas M, Kawczynski MJ, de Waha S, et al. Updated 5-year outcomes of transcatheter versus surgical aortic valve replacement in patients with severe aortic stenosis at low- to intermediate-surgical risk. *Heart*. Published online February 11, 2026. doi:10.1136/heart-

## Early Surgery After Hip Fracture Improves Patient Outcomes

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Hip fractures are a common cause of morbidity and mortality in older adults, and cause a big burden on healthcare systems worldwide.<sup>1</sup> With an ageing population, the number of hip fractures is expected to increase significantly in the coming decades. The timing of surgery has, therefore, become an important indicator of the quality of care provided to these patients.

Mazarello Paes et al.<sup>1</sup> conducted a systematic review to evaluate the association between time to surgery and patient outcomes after hip fracture in adults aged 50 years and older. The authors screened 24,791 articles and included 139 studies, involving more than 4.3 million patients across 36 countries.

Because of variations in study design and definitions of “early surgery”, a formal meta-analysis could not be performed and the results were summarized narratively.

Overall, earlier surgery was associated with better outcomes. Operations performed within 48 hours of injury or hospital admission were linked to improved mobility, better recovery, shorter hospital stays, and fewer complications. Early surgery was also associated with lower healthcare costs and reduced mortality. Some studies indicated that surgery within 24 hours may provide additional benefits, including improved quality of life and fewer reoperations.

These findings support current recommendations advocating early surgical treatment for hip fractures in older patients.<sup>1</sup>

1. Mazarello Paes V, Ting A, Paes MVI, Masters J, Graham SM, Costa ML. What is the association between time to surgery and patient outcome after hip fracture? A systematic review. *Bone Joint J*. 2026;108(1):30-38.

## More than a Cure: Approach in Dementia Care

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With her eyes full of tears, and heart full of guilt and helplessness as she was losing control over her own life, she asked:

**“WHY IS THERE STILL NO CURE FOR DEMENTIA?”**

The impact of disease is more than just physical symptoms. The emotional and social consequences of illness, as well as the functional limitations that it may cause, affect how patients experience their condition. During my general practice internship, I accompanied a general practitioner on a home visit which included a neurological case that made this particularly clear.

We visited a patient with dementia to assess the progression of her condition. I noticed how everyday activities, such as self-care and managing appointments, were subtly, but noticeably, influenced by dementia. Her spouse explained that he had taken on the responsibility of many everyday activities. He expressed that he did it out of love, emphasizing that he did not feel burdened.

Although the patient’s dementia was obviously progressive, she reflected on her condition and inabilities, and stated that she felt uncomfortable seeing her spouse take on so many tasks.

**“Their interactions highlighted the emotional difficulties and the complexity of living with dementia.”**

This struck me, because I realized that even patients with dementia may have the ability to stay aware of the consequences of their condition not only for themselves, but also for the people around them.

That realization made me think more about the art of communication with patients, and the various dimensions that should be explored during interactions. Surely in neurological diseases such as dementia, having a better understanding of the patient’s perspective and the role of their relatives is essential for providing patient-centered, holistic care. Observing the patient’s home environment and the relationship with their spouse broadens our insight into the patient’s experience with illness.

Thus, with a holistic approach we can develop a deeper understanding of a patient's behaviour. Moreover, it allows us to see whether they and their closest relatives receive the support they need, such as organizing home care or making practical adjustments at home to ensure safety and independence. The caregiver can be supported by providing relieving day care activities. Psychological counseling for the patient and their caregiver is also an option.

**EVEN THOUGH THERE IS NO CURE FOR DEMENTIA**, a holistic approach allows one to come closer to what really matters: supporting and guiding patients as well as possible during the course of their illness.

# Indocyanine Green in Plastic and Reconstructive Surgery: Illuminating the Invisible

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Over the past two decades, indocyanine green angiography (ICG-A) has evolved from a novel experiment to an increasingly integrated component of modern plastic and reconstructive surgery. ICG-A is a real-time fluorescent imaging technique to assess tissue perfusion intraoperatively during surgical procedures. After intravenous administration, indocyanine green (ICG) binds to plasma proteins in the blood and emits fluorescence when exposed to near-infrared light. This enables surgeons to distinguish between viable and non-viable tissue and guide intraoperative decisions, such as excising poorly perfused areas to reduce the risk of complications, including necrosis. Compared with earlier fluorescent dyes, ICG has a shorter half-life, enabling repeated use, and demonstrates a more favorable safety profile.<sup>1</sup>

The clinical relevance of ICG-A is increasingly supported by emerging evidence. A recent systematic review and meta-analysis by Wang et al. investigated the use in deep inferior epigastric perforator (DIEP) flap breast reconstruction. The study found that intraoperative ICG-A was associated with a significantly lower incidence of postoperative fat necrosis compared with clinical judgement alone (10.89% versus 21.53%), as well as reduced reoperation rates (10.42% versus 32.82%). Based on this, ICG-A seems to be a promising tool for assessing flap perfusion and improving surgical outcomes.<sup>2</sup> Beyond breast reconstruction, ICG-A is also widely used in head and neck and extremity reconstruction, where it has proven effective in assessing tissue perfusion.<sup>3</sup>

**FIGURE 1** illustrates the practical implications of ICG-A in clinical decision-making. In this case, the technique was used to visualize perfusion of a mastectomy skin flap during implant-based reconstruction, revealing a central area of reduced fluorescence signal. Despite this finding, the affected tissue was not excised intraoperatively (possibly due to favorable clinical findings).

Five days post-operatively, the patient developed necrosis corresponding to the previously identified hypoperfused region. This case shows the added value of ICG-A in detecting hypoperfusion beyond clinical assessment.<sup>3</sup>

Looking toward the future, ICG-A is likely to further reshape surgical decision-making, although some challenges remain. One limitation is the lack of standardized interpretation protocols. Additionally, the technology requires specialized equipment and training, which may increase costs and limit accessibility.<sup>4</sup> Recent research highlights the potential for quantitative assessment of flap perfusion using ICG-A, which may help reduce subjective interpretation and support more objective intraoperative decisions.<sup>5</sup> Future developments may expand the use of ICG-A and contribute to a broader changing perspective in plastic surgery, where imaging-guided surgery is becoming increasingly central to improving patient outcomes.

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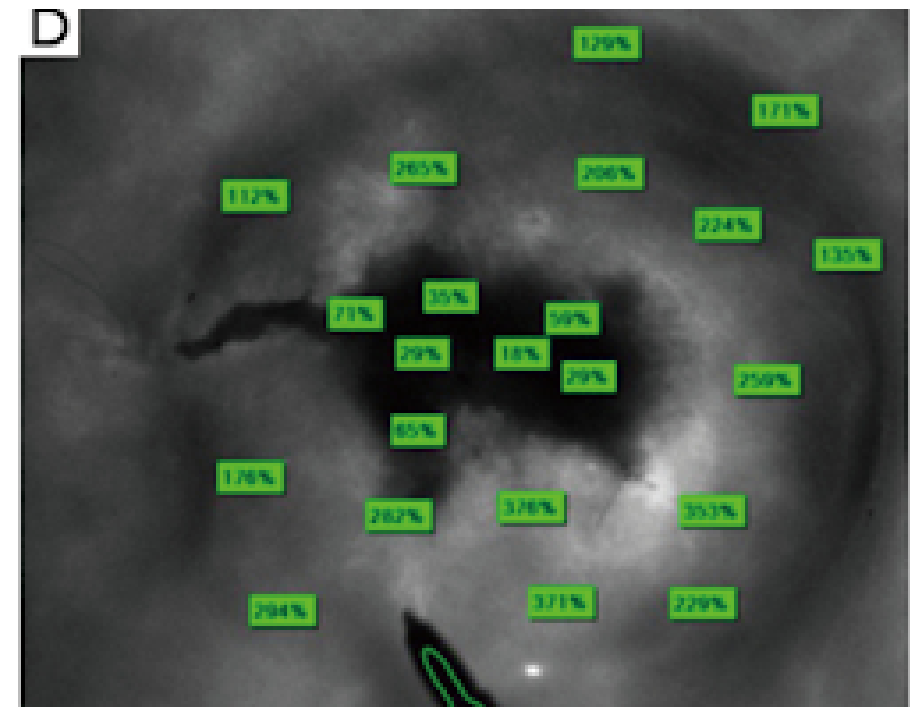
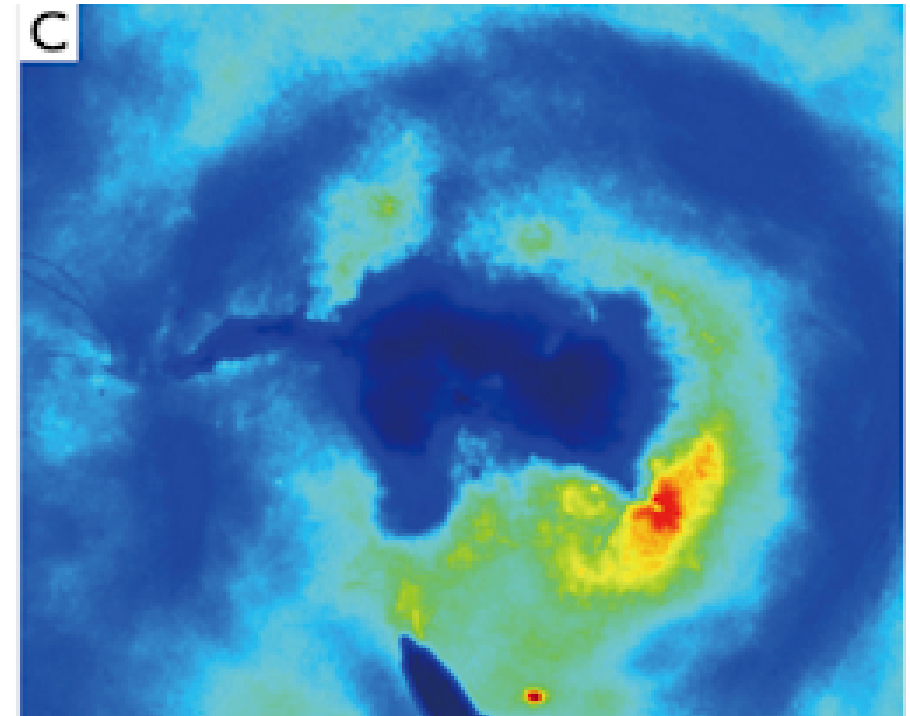


FIGURE 1

# MEET OUR TEAM

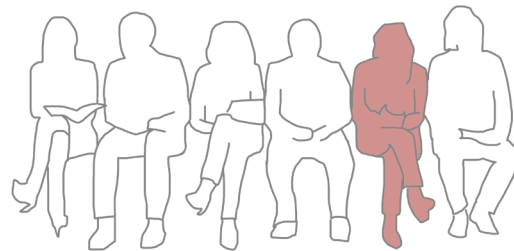
Hii! My name is Hannah. I'm a biomedical sciences graduate who is currently pursuing the master's programme Health Sciences, specialising in infectious diseases. I joined AMSj last December after hearing about it from a fellow student. At the time, I was looking for a low-threshold way to become more involved in the medical world outside my studies. When I heard about AMSj, I was immediately enthusiastic. It seemed like the perfect way to get closer to medical research and the people behind it.

Within the board I serve as Vice Chair and focus on PR. I work on communication, social media and organising activities. One of the projects I'm currently most involved in is organising the Nicolaes Tulp Symposium (NTS). The symposium is a great opportunity for students to present their research and connect with others who are interested in science. So, if you are currently writing your thesis or have recently finished it, consider submitting it for the NTS research prize :)

So far, my experience within AMSj has been very positive. It's inspiring to work with a group of motivated students and closely involved doctors who are all enthusiastic about research and education. I think AMSj offers medical students an accessible way to engage with science. Whether this is by reading articles, writing for the journal, or getting involved behind the scenes.

In the future, I hope AMSj can continue growing its community and inspire even more students to share and discuss their research!!

## Hannah, Vice Chair



## Understanding Trauma Through Research

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**DURING MY CLINICAL ROTATIONS**, I found myself searching for more depth beyond the structure of daily patient care. While I enjoyed the clinical environment, I wanted to better understand the reasoning behind decisions and the evidence that supports them. This curiosity led me to explore scientific research alongside my rotations. I initially started in orthopedic research, focusing on glenoid components, but gradually realized that my interests were more closely aligned with trauma and vascular surgery. Fields where rapid decision-making and physiological insight are essential.

Driven by this interest, I reached out to several surgeons and was given the opportunity to work with a military trauma surgeon. Under his supervision, I conducted a retrospective study on blunt traumatic aortic injury (BTAI), a rare but often fatal condition typically caused by high-energy trauma such as traffic accidents.<sup>1</sup> At the start, this was a relatively unfamiliar topic to me, but that quickly changed as I became immersed in the data and the clinical stories behind it. The study is currently in preparation for publication, which has been an exciting milestone in understanding how clinical research translates into broader knowledge.

Our cohort consisted of 393 patients, predominantly male (77.9%) with a mean age of 50.3 years. Of these, 62 patients (15.8%) initially presented to a non-trauma center, while the remaining 331 (84.2%) were admitted directly to a designated trauma center. Given that BTAI requires rapid CT angiography and in higher-grade injuries, prompt surgical intervention, this proportion raises ques-

tions about current prehospital triage protocols. It made me realize how much impact decisions made before a patient even reaches the hospital can have on outcomes.

Working with this dataset also challenged me in unexpected ways. One of the biggest frustrations and at the same time, learning point, was the amount of missing data. At times, it felt like trying to solve a puzzle with missing pieces. For example, key variables such as CT status or 30-day outcomes were not always available, which limited the conclusions we could draw. However, this limitation forced me to shift my perspective. Instead of focusing on what the data could not show, I learned to appreciate what it could reveal. Even descriptive findings provided valuable insights into the epidemiology and presentation of BTAI in the Netherlands. It also made me more aware of the importance of data quality and careful interpretation in research.

This project taught me that research is rarely straightforward. It involves setbacks, critical reflection, and continuous learning. More importantly, it showed me how closely research and clinical practice are connected. For me, this experience not only strengthened my interest in trauma and vascular surgery but also confirmed my motivation to continue combining clinical work with scientific research in the future.

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## From Promise to Practice: What It Takes to Implement AI in Healthcare

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**ARTIFICIAL INTELLIGENCE (AI)** is increasingly being presented as the next step in improving healthcare. Predictive models can estimate risks, support decisions, and tailor treatments to individual patients, while large language models are increasingly used to generate clinical summaries and support documentation. The innovations are developing rapidly, and the potential is clear. Yet in most of healthcare, these tools are still absent.

This raises a simple but important question: *If the technology is ready, why is it not being used?*

Part of the answer seems to lie in how we think about implementation. It is tempting to see AI as something that will naturally find its way into practice once it performs well enough. In reality, implementation is less about performance and more about fit. These tools need to align with clinical workflows, decision-making processes, and the people who use them.

In our work on barriers to machine learning in surgery, this became clear. Stakeholders across healthcare, research, and industry pointed to recurring challenges. Clinicians often don't trust these systems, partly because they haven't been trained to use them. Also, integrating these models into current work processes can be difficult. Accessing data can be a challenge, and the qual-

ity of the data can vary. Regulatory requirements are complex, and the economic value is not always clear.

What stands out is how connected these issues are. Limited understanding affects trust. Low trust slows adoption. Without adoption, it is difficult to demonstrate value. Implementation stalls not because the model fails, but because the system around it is not ready.

Another perspective that is often overlooked is that of the patient. Patients are rarely part of the conversation on AI implementation, yet their views are essential.

In our study exploring patient perspectives on AI in surgery, patients were generally open to its use.<sup>1</sup> Many saw it as a valuable addition to clinical expertise, similar to an extra pair of eyes supporting decision-making. However, this openness was not without conditions.

Patients consistently emphasised that the clinician should remain responsible for the final decision. The model can inform, but it should not decide. Trust remains with the “human in the room”, and this trust should not be replaced by reliance on an algorithm. This is not a rejection of AI, but a clear expectation of how it should be used.

**THIS SHIFTS THE PERSPECTIVE.** AI is not the centre of the conversation. The patient–doctor relationship is.

For us as medical students, this creates both a challenge and an opportunity.

We are entering a field where AI will become part of daily practice, whether we are ready or not. Developing a basic understanding of these tools is no longer optional. This does not mean learning how to train models, but learning how to interpret them, question them, and use them responsibly.

At the same time, medical students are in a unique position to connect different worlds. AI research and clinical practice often remain separate, with limited interaction. Students who engage with both can help bridge this gap by bringing clinical insight into technical development and vice versa.

It is also important to keep the focus where it belongs. Implementation is often discussed in terms of performance, validation, and regulation. These are necessary, but they are not sufficient. If these tools are to make a positive impact, they need to address what matters to patients and clinicians. Not just as a technological innovation, but as part of a system centred around patients and clinicians.

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## Renewed pocket Dermatology: including skin of color

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Dermatological conditions in individuals with darker skin types have historically been underrepresented in both medical education and scientific research. Modern dermatology developed largely within a Eurocentric framework during the nineteenth and twentieth centuries, resulting in descriptions and visual representations of skin disease that are predominantly based on lighter skin types<sup>1</sup>. As a consequence, conditions in more pigmented skin are more likely to be misdiagnosed or recognised at a later stage, contributing to health disparities such as delayed treatment, suboptimal outcomes, and increased healthcare costs<sup>2</sup>.

Recent Dutch research confirms that this imbalance persists today. In commonly used dermatology textbooks, nearly 90% of images depict light skin, while deep skin tones are rarely shown<sup>3</sup>. Such underrepresentation directly affects visual pattern recognition, a core diagnostic skill in dermatology, and limits clinicians' ability to confidently assess skin disease across all skin types<sup>1,3</sup>.

A brief clinical case illustrates this gap:

**A 32-YEAR-OLD WOMAN** with a dark skin type presents to the dermatologist with recurrent facial complaints. On inspection, there were subtle textural changes and scattered papules, with minimal visible erythema. Previous consultations focused on eczema and acne, and the patient was treated with topical corticosteroids and keratolytics, resulting in limited treatment response. The diagnosis of rosacea had not been considered as the typical erythema and flushing were difficult to appreciate.

This case poses the following questions: Which clinical clues are decisive in recognising rosacea in darker skin? And how can diagnostic reasoning be adapted when classical visual signs are less apparent?

The latest edition of the Dermatology Pocket Compendium<sup>4</sup> has been revised to address, among other things, exactly these challenges. It has been substantially expanded to encompass a wide range of common dermatological conditions as well as rarer pathologies across different skin types. Particular emphasis is placed on recognising differences in clinical presentation between lighter and darker skin, ensuring that diagnostic features are interpreted in a broader clinical context. Accordingly, the pocket now includes a diverse image set, with more than half of the clinical images in this edition depicting patients with skin of colour, better reflecting real-world patient populations and reducing educational blind spots. The pocketbook remains concise and practical, designed for use by medical students during medical rotations and young doctors who require reliable guidance at the bedside or in the outpatient clinic.

By addressing both clinical knowledge gaps and underlying educational biases, the renewed Dermatology Pocket contributes to a more accurate, inclusive, and equitable approach to dermatological care, better preparing future physicians for an increasingly diverse society.

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## Clinical Image: When a rash spreads fast

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### CASE

**A 32-YEAR-OLD MAN** presents at the emergency department with a 4-day history of fever and a rapidly spreading skin eruption. Five weeks earlier he started allopurinol for gout and ibuprofen for pain.

Physical examination shows a widespread erythematous maculopapular rash covering the trunk and extremities. Marked facial edema is present, particularly around the periorbital region. The rash is mildly pruritic but not painful. The patient reports malaise and a temperature of 39.2 °C.

Laboratory tests reveal leukocytosis with eosinophilia ( $1.8 \times 10^9/L$ ) and elevated liver enzymes (ALAT 180 U/L). Enlarged cervical lymph nodes are palpable.

A clinical photograph of the skin lesions is shown.



FIGURE Skin lesions on patient.

### QUESTION 1

Which feature in this case most strongly suggests a severe drug hypersensitivity reaction rather than a simple drug eruption?

- Fever and malaise
- Facial edema with eosinophilia
- Mild pruritus of the rash
- Rash involving the trunk and extremities

### QUESTION 2

Which medication is most commonly associated with the development of DRESS syndrome (Drug Rash with Eosinophilia and Systemic Symptoms)?

- Amoxicillin
- Allopurinol
- Ibuprofen
- Metformin

### QUESTION 3

Which internal organ is most frequently affected in DRESS syndrome?

- Liver
- Heart
- Brain
- Pancreas

### QUESTION 4

What is the most important initial management step when DRESS syndrome is suspected?

- Immediate discontinuation of the suspected drug
- Start broad-spectrum antibiotics
- Prescribe topical corticosteroids only
- Perform a skin biopsy before treatment

## Ryeqo: another approach to endometriosis-related pain

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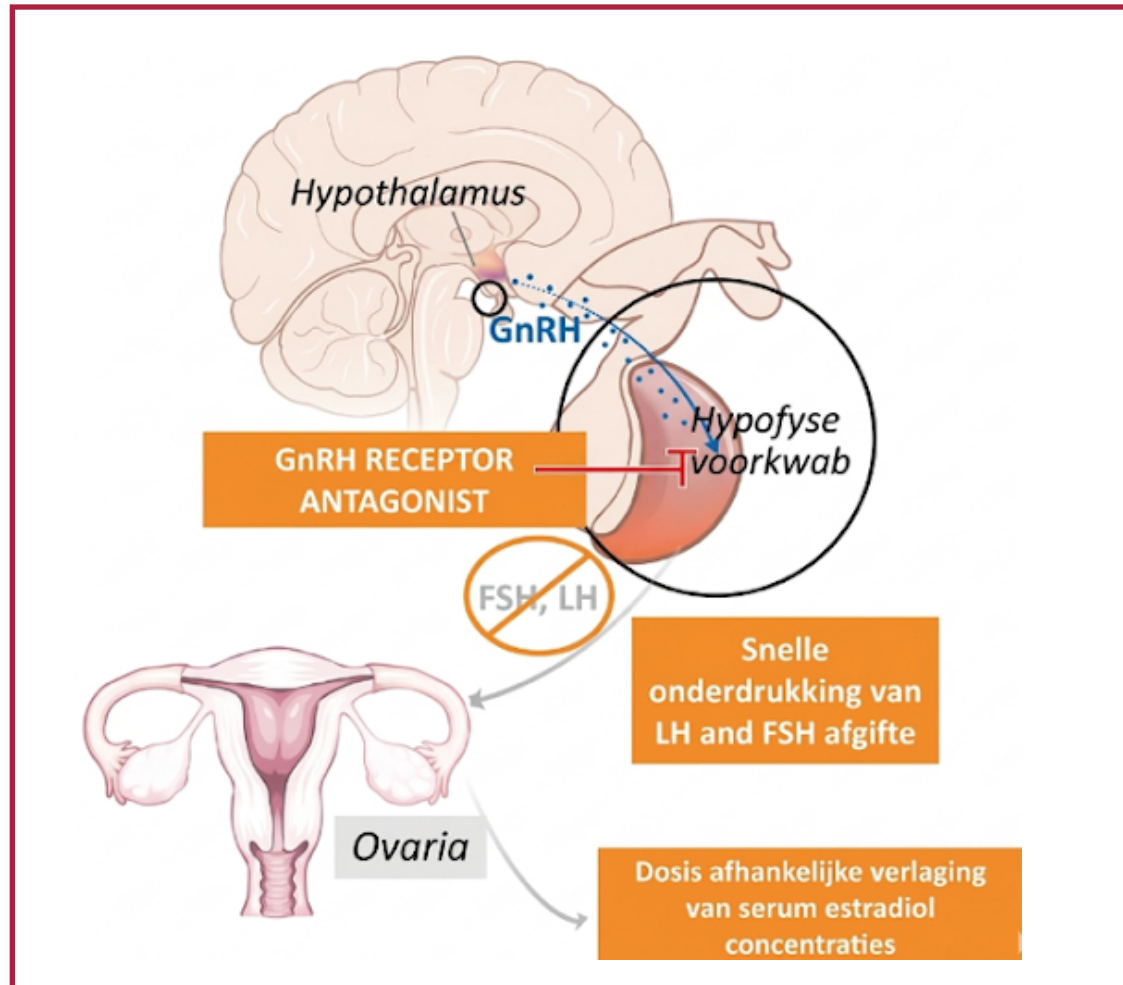


FIGURE 1 Mechanism of action of oral GnRH antagonists<sup>6</sup>

**UTERINE FIBROIDS AND ENDOMETRIOSIS** are common gynaecological conditions in women of reproductive age and are often associated with significant morbidity.<sup>1,2</sup> Treatment usually starts with first-line therapy consisting of analgesics, e.g. paracetamol or NSAIDs, and/or combined hormonal contraceptives or progestogens, e.g. oral, IUD or implant.<sup>3</sup> If this treatment proves to be ineffective, second-line therapy may be considered.

otics, e.g. paracetamol or NSAIDs, and/or combined hormonal contraceptives or progestogens, e.g. oral, IUD or implant.<sup>3</sup> If this treatment proves to be ineffective, second-line therapy may be considered.

Ryeqo<sup>®</sup> is indicated in adult women of reproductive age for the treatment of moderate to severe symptoms of uterine fibroids, as well as for the symptomatic treatment of endometriosis in patients with a history of prior medical or surgical intervention for the condition.<sup>4</sup> It is a fixed-dose combination consisting of 40 mg relugolix, 1 mg estradiol and 0.5 mg norethisterone acetate. Relugolix is a GnRH-antagonist that blocks GnRH receptors in the pituitary gland. This decreases the secretion of LH and FSH, leading to reduced ovarian estrogen production **FIGURE 1**. Lower estrogen levels result in a reduction of symptoms associated with uterine fibroids and endometriosis. Because suppression of estrogen and progesterone can cause hypo-estrogenic adverse effects, estradiol and norethisterone acetate are added as add-back therapy. Estradiol reduces symptoms associated with a hypo-estrogenic state, such as vasomotor symptoms and loss of bone mineral density.<sup>3</sup> Norethisterone acetate blocks the effects of estradiol on the uterus, diminishing the risk of endometrial hyperplasia.<sup>3</sup>

Unlike other GnRH-antagonists, relugolix is a non-peptide small-molecule that can be absorbed through the gastrointestinal tract. This allows for convenient once daily oral dosing instead of parenteral administration. Relugolix has an absolute bioavailability of 11.6% with a peak plasma concentration reached after 3 hours.<sup>3</sup> Its pharmacokinetic profile is characterized by a high susceptibility to drug-drug interactions, as its metabolism primarily depends on CYP3A/5 (45%) and CYP2C8 (37%). Potent CYP3A4 inhibitors, e.g. antifungal agent ketoconazole or the well-known interaction with grapefruit fruit juice, increase exposure. Similarly, P-gp inhibitors such as the antibiotic erythromycin can raise plasma levels up to 400%, requiring at least a 6-hour dose separation.<sup>4</sup> The effective elimination half-life is approximately 25 hours supporting once daily administration.<sup>3</sup> Common side effects include headache, hot

flushes, fatigue and irregular vaginal bleeding.<sup>3</sup> Hypo-estrogenic effects such as decreased bone mineral density may occur, although the added estradiol and norethisterone acetate help reduce these risks. Important contraindications include pregnancy, severe liver disease, hormone-dependent malignancies and a history of thromboembolic disorders.<sup>3</sup>

Lastly, at approximately €3.12 per day, a tablet of Ryeqo<sup>®</sup> is not only more patient-centric but also potentially more cost-effective than traditional parenteral GnRH-agonist therapy.<sup>3</sup> While a leuprorelin injection costs approximately €3.05 per day, this excludes the additional costs of separate add-back therapy.<sup>5</sup> Beyond financial savings, Ryeqo<sup>®</sup> offers significant autonomy as patients are no longer required to schedule clinical appointments for parenteral administration.

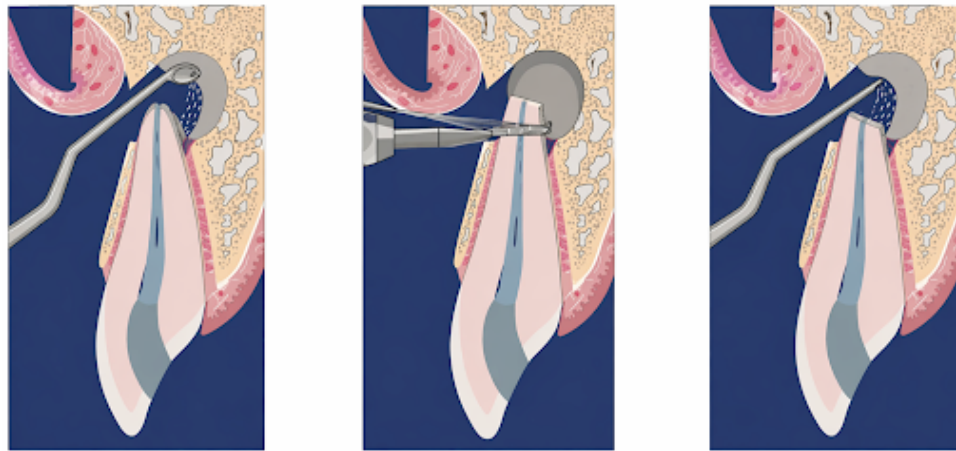
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## Apical Surgery

MERT ULUÇ<sup>1</sup>

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**FIGURE 1** Schematic representation of apicoectomy including a) periapical curettage, b) root-end resection, c) retrograde filling at the apex of a retained root <sup>2</sup>

When dental caries reach the nerve, the infection can migrate down the root towards the bottom of the root (apex) and trigger inflammation in the surrounding bone. To treat this, the dentist performs a root canal treatment (RCT), in which the pulp chamber and canals are emptied of its vasculature and nerve, and are then disinfected of any remaining bacteria. The problem, however, is the bottom 3mm (apical delta), where bacteria may be hidden inside the many accessory canals. Initially, the RCT may seem successful, but pain may arise at a later point. To combat this, a re-RCT can be performed, especially if there are doubts regarding the quality of the initial RCT, or apical surgery can be performed.

Apical surgery is a clinical procedure performed under local anesthesia. An incision is made near the apex of the root, which can also be palpated by feeling the contour on the gingiva (gums). After the incision, the muco-

periosteal flap is elevated, revealing the cortical bone underneath. By drilling a small hole, the apex can be seen with inflamed tissue attached to it. The root is then resected with a cylindrical burr, usually by at least 3mm. Following removal of the apical delta, the canal, which has previously been filled with a rubber material (guttapercha) during the initial RCT, is cleaned. This is done by inserting an ultrasonic cleaning tip, usually 2mm into the canal. This further cleans the canal and provides support for the next step. Finally, a biocompatible filling is placed in the created canal opening and on the root surface, providing a proper apical seal.

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## A Practical Guide to Geriatric Care: The Pocket Ouderengeneeskunde by Compendium Geneeskunde

HANNAH VAN DER GIESSEN<sup>1</sup>, YASSMINA DERRAZE<sup>2</sup>  
<sup>1</sup> General Board Member AMSJ



As populations worldwide age at an accelerating rate, healthcare systems are increasingly confronted with complex older patients who require a different approach than the traditional, disease-oriented model<sup>1,2</sup>. Despite this, medical practice and healthcare systems have traditionally been organized around individual diseases, while the care for older adults calls for a broader, more integrative perspective<sup>3</sup>. The Pocket Ouderengeneeskunde by Compendium Geneeskunde aims to bridge this gap by offering a compact yet clinically relevant overview of key principles in geriatric care.

For many medical students, geriatrics can initially feel overwhelming and difficult to structure. During clinical rotations, patients often present with multiple conditions and atypical symptoms, which can make clinical reasoning difficult. This pocket responds well to that challenge. It focuses on overarching geriatric themes such as frailty, multimorbidity, polypharmacy, and palliative care. By organizing information around these core concepts, it supports students in developing a more holistic and structured approach to patient care.

The layout is designed with practicality in mind. Information is presented in a structured and highly accessible format. It frequently uses schematic overviews, step-by-step approaches, and summary tables. This makes the pocket particularly useful during clinical rotations, where quick reference and clarity are essential. For example, common geriatric syndromes such as delirium, falls, and cognitive impairment are discussed in a way that directly translates to bedside decision-making. This approach helps students to structure their clinical reasoning and engage more confidently with complex geriatric patients.

While the compact nature of the pocket unavoidably limits the depth of certain topics, this is also its primary strength. It complements

comprehensive textbooks by providing a practical guide small enough to carry on the ward, that helps students and clinicians navigate through the complexity of geriatric care. In doing so, it lowers the threshold for engaging with this often challenging field.

Another important aspect is the focus on decision-making in relation to quality of life. The pocket shows that medical decisions in older patients should not only be based on disease outcomes, but also on functional status, patient preferences, and overall well-being. This aligns with the increasing focus on person-centred care and is especially useful for students learning to balance clinical guidelines with individual patient needs.

In conclusion, the Pocket Ouderengeneeskunde is a valuable addition to the Compendium series. The clinically oriented approach, combined with a clear and structured presentation, makes it particularly suitable for medical students and early-career clinicians. By translating complex geriatric concepts into accessible and applicable knowledge, it contributes to better preparedness for the realities of an ageing population.

For students interested in exploring this pocket themselves, Compendium Geneeskunde offers a **10% DISCOUNT** using the code **AMSJ10**. A worthwhile addition for anyone aiming to navigate geriatric complexity with greater confidence!

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## Procalcitonin: a more specific biomarker in suspected infection

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**A PATIENT IS ADMITTED TO THE INTENSIVE CARE UNIT** with suspected sepsis, presenting with a fever, tachycardia, and tachypnea. This poses a common clinical dilemma: is there a bacterial infection, or could these symptoms be explained by a viral or non-infectious cause? Clinicians can rely on their assessment as well as laboratory markers such as C-reactive protein (CRP), white blood cell count (WBC), and sedimentation rate (ESR)<sup>1,2</sup>. However, these biomarkers lack specificity for a bacterial infection and could be increased in various inflammatory diseases. Procalcitonin (PCT) is a relatively new biomarker that has gained increasing attention<sup>3</sup>, as it has more favorable test characteristics for distinguishing bacterial from non-bacterial inflammation. As PCT levels are known to rise rapidly during a bacterial infection<sup>4</sup>, it could provide additional value for clinical decision-making, especially in acute care settings, such as emergency care and the ICU. But how does PCT levels indicate a bacterial infection, and how reliable is it?

### WHAT IS PROCALCITONIN?

PCT is the precursor of calcitonin, a hormone involved in calcium regulation. Under normal circumstances, PCT is produced by the thyroid C cells and only very small amounts circulate in the blood. However, during systemic bacterial infections, the PCT production rises drastically. Instead of only being produced in the thyroid, other tissues like the liver, pancreas, and kidneys also start synthesizing PCT. The rise of production is a response to circulating endotoxins or cytokines, like interleukin (IL) 1b and tumor necrosis factor (TNF) alpha. Conversely, the cytokines released during a viral infection, like interferon (IFN) gamma, inhibit PCT production<sup>4</sup>. Usually, PCT levels begin to rise within 4-6 hours after onset of a bacterial infection and peak around 12-24 hours. If appropriate treatment is started, the levels decline relatively

fast, making PCT useful for monitoring response to therapy<sup>1</sup>.

### INTERPRETATION & CLINICAL VALUE

The results are normally interpreted using threshold values<sup>5</sup>:

- <0.05 ug/L: normal levels in healthy individuals
- 0.05-<0.5 ug/L: systemic infection unlikely, localized infection possible
- 0.5->10 ug/L: systemic bacterial infection becomes increasingly more likely

It is important to consider that these absolute values alone are not always decisive. Therefore, monitoring the PCT values of a patient over time provides an even better conclusive picture and can be used to guide antibiotic treatment. When the PCT levels fall to <0.5 ng/mL or <80% of its peak level, treatment can be discontinued<sup>1</sup>. Compared to CRP, WBC, and ESR, PCT shows a more rapid response to bacterial infection<sup>1,6,7</sup> and higher specificity for bacterial infection<sup>1,2,5</sup>, contributing to its role as a more effective biomarker.

### WHICH DIAGNOSIS CAN BE MADE?

PCT results can be helpful in distinguishing diagnoses as sepsis, severe bacterial pneumonia, and other systemic bacterial infections<sup>1,8</sup>. However, it is less useful in mild or localized infections, as the PCT levels remain low. Importantly, elevated PCT levels may also occur in non-infectious situations, such as major surgery, severe trauma, burns, and certain carcinomas<sup>4</sup>. In these cases, the abnormal results can be attributed to systemic inflammation instead of infection. Another important condition to consider is chronic kidney disease, as PCT levels can be falsely elevated<sup>1,2</sup>. Therefore, PCT should always be interpreted alongside the patient's history, physical examination, and other

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## Stroke in a 37-Year-Old Patient

MAARTJE C. MONTAUBAN VAN SWINDREGT<sup>1</sup>,  
MATTHIJIS J. VAN EE<sup>1</sup>, AND PROF. DR. MARIO MAAS<sup>2</sup>

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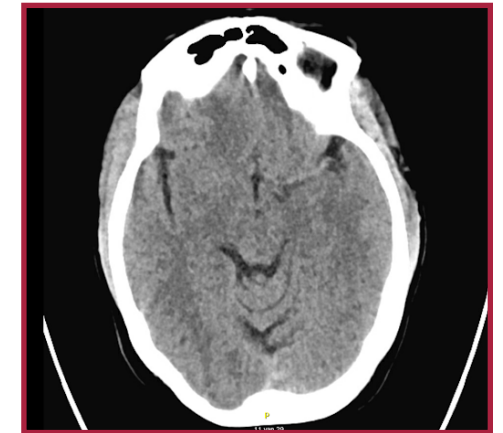
A 37-year-old woman presents with sudden-onset right-sided weakness, facial droop, impaired speech, and difficulty walking. A computed tomography (CT) scan of the head was performed.

CASE

### QUESTION 1

The CT shows no intracranial haemorrhage. However, there is a sign suggestive of ischemia. What do we see?

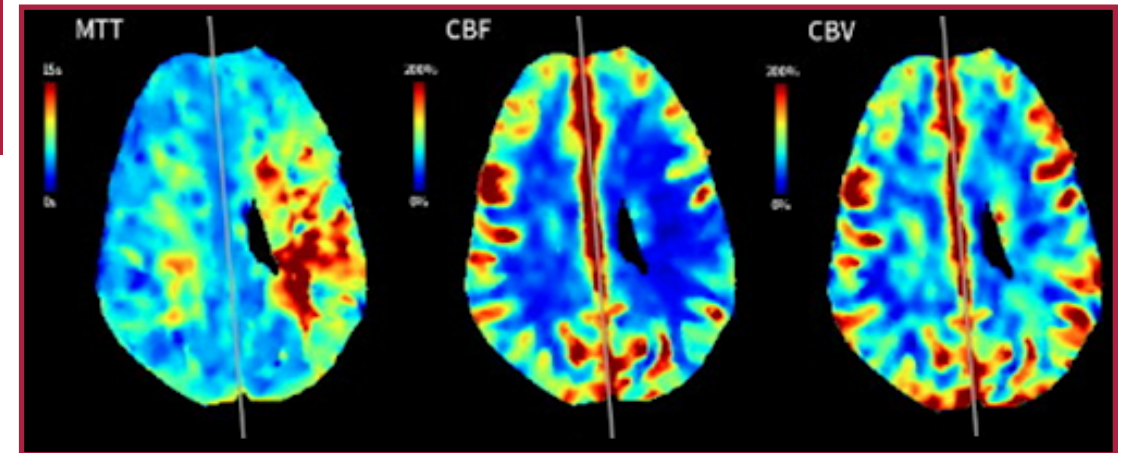
- A. Dense vessel sign
- B. Hypo attenuating brain tissue
- C. Obscuration of the nucleus lentiformis
- D. Insular ribbon sign



### QUESTION 2

Based on the imaging and clinical presentation, which artery is occluded?

- A. Left anterior cerebral artery
- B. Left middle cerebral artery
- C. Left posterior cerebral artery



### QUESTION 3

CT perfusion (CTP) differentiates salvageable ischemic tissue (penumbra) from irreversibly infarcted tissue (infarct core). What is the correct interpretation of this CTP?

- A. Large infarct core with small penumbra
- B. Infarct core without penumbra
- C. Penumbra without infarct core

### QUESTION 4

The following abnormality is seen on CT angiography. What is the diagnosis?

- A. Atherosclerotic carotid plaque.
- B. Carotid web
- C. Carotid artery dissection
- D. Intraluminal carotid thrombus



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Answer on page 23 ►

Answer on page 23 ►

## Research Abroad: Master Thesis at The Hospital of Sick Children in Toronto

THOMAS F.C. MEULENDIJKS<sup>1</sup>

<sup>1</sup> Faculty of Medicine, Amsterdam UMC, University of Amsterdam

My name is Tom Meulendijks. I am 24 years old and currently in my final year of medical school. In November 2023, I travelled to Canada for four months to investigate how long pediatric medulloblastoma and ependymoma survivors should be screened for disease recurrence. This research project was conducted at The Hospital for Sick Children (SickKids) in Toronto.

### RESEARCH PROJECT

To investigate the optimal surveillance duration for pediatric medulloblastoma and ependymoma survivors, two types of childhood brain cancer, I performed a retrospective cohort study at SickKids. The study included all survivors treated between 2000 and 2017 that continued to undergo surveillance beyond 5 years after diagnosis.

In total, 129 survivors met the inclusion criteria, and I analyzed 711 surveillance MRI scans. The results showed that routine imaging in ependymoma survivors led to multiple asymptomatic detections of recurrence, which were associated with improved survival compared to recurrences detected after symptom onset, supporting the continuation of surveillance for at least 10 years after diagnosis for recurrence detection. This association was not observed in survivors of medulloblastoma. However, screening may still play an important role in monitoring treatment-related changes and detecting subsequent neoplasms, although the optimal timing and frequency remain subjects of ongoing debate.<sup>1</sup>

### APPLICATION PROCEDURE

I decided that I wanted to conduct my master's thesis abroad during the final year of my bachelor's degree. Having completed my bachelor thesis in pediatric oncology, I was eager to continue research within this field. As I speak only Dutch and English, I focused on opportunities in the United Kingdom, Canada, and the United States.

Some of the world's leading pediatric oncology centers include the Prinses Máxima Centrum in Utrecht (where I conducted my bachelor thesis), St. Jude Children's Research Hospital in Tennessee, and SickKids in Toronto. As I had never been to Canada, I chose to look for an opportunity at SickKids. After reviewing the research interests of pediatric oncologists at

SickKids, I contacted several professors using the email provided on the hospital website. I was fortunate to be invited for a meeting with one professor, and together we came up with a suitable research topic.

The subsequent logistical process took more than six months. I arrived in Toronto on November 20th 2023, and received a warm welcome from my supervisor and the pediatric oncology team the following day.

### DIFFERENCES AND DIFFICULTIES

In the months prior to departure, I worked on obtaining approval for the project. As an external researcher, requesting access to sensitive data from hundreds of pediatric cancer survivors was a challenging process. However, with the support of my supervisor and his team, I received approval before my arrival, allowing me to start without any difficulties. My hospital badge, computer, and account were all prepared in advance.

### LEARNING POINTS

My time in Toronto was an incredibly valuable experience, both academically and personally. I was able to publish my manuscript and present the outcomes in Lucerne, Switzerland. This experience showed me the importance of having a supportive supervisor and research team when working abroad.

While my stay itself was extremely positive, the months leading up to it were marked by contract negotiations, insurance issues, and numerous logistical challenges. If I were to undertake a similar project again, I would consult the International Office from the outset about existing partnerships with Amsterdam UMC to reduce uncertainty and streamline the process.

I would wholeheartedly recommend studying abroad to everyone, not only for academic growth, but also for personal development. Do not overthink the process or be discouraged by potential hurdles along the way. Sometimes, finding a supervisor abroad can start with something as simple as sending an email!

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## Answers 'When a rash spreads fast'

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**Correct answers: B, B, A, A**

### EXPLANATION

**Answer 1:** B Facial edema with eosinophilia.

Facial edema combined with eosinophilia indicates a systemic drug hypersensitivity reaction (DRESS) rather than a simple rash, which usually lacks hematologic and systemic involvement. Fever and malaise (A) are non-specific, mild pruritus (C) is common in minor drug reactions, and rash distribution alone (D) does not indicate severity.

**Answer 2:** B Allopurinol

Allopurinol is among the most frequent triggers of DRESS syndrome, along with aromatic anticonvulsants such as carbamazepine and lamotrigine. Amoxicillin (A) and ibuprofen (C) rarely cause DRESS, and metformin (D) is not typically associated with severe drug hypersensitivity reactions.

**Answer 3:** A Liver

Hepatic involvement is the most common internal organ manifestation in DRESS syndrome, occurring in up to 60–80% of patients. This typically presents as hepatitis with elevated liver enzymes (ALAT/ASAT), as in the case above. Liver injury can range from mild and transient to severe, and in rare cases may progress to liver failure, making early recognition and drug withdrawal essential.

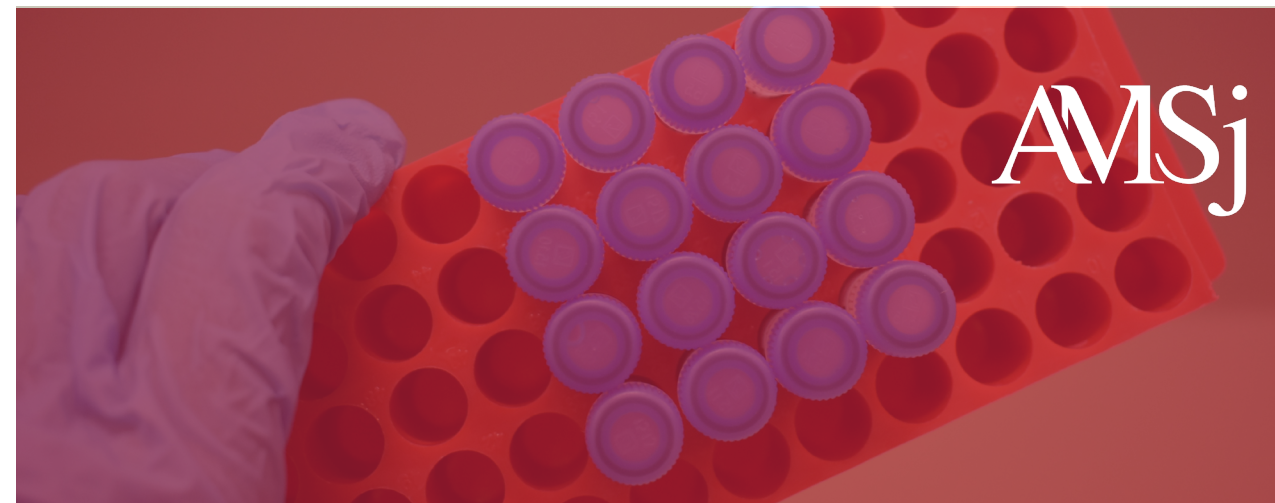
Cardiac involvement (B) such as myocarditis, central nervous system involvement (C), or pancreatic involvement (D) are uncommon and not defining features of DRESS. Monitoring liver function is therefore an important part of patient management.

**Answer 4:** A Immediate discontinuation of the suspected drug

Prompt withdrawal of the offending medication is the critical first step to prevent progression and organ damage. Broad-spectrum antibiotics (B) are not indicated unless there is a confirmed infection; topical corticosteroids alone (C) are insufficient for systemic involvement; and a skin biopsy (D) is primarily diagnostic but should not delay treatment.

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## Answers 'Stroke in a 37-Year-Old Patient'



Correct answers: 1A, 2B, 3C, 4B

### EXPLANATION

Acute stroke imaging detects intracranial haemorrhage, identifies vascular occlusion amenable to reperfusion therapy, and evaluates the extent of brain injury.

Non-contrast CT shows a hyperdense left middle cerebral artery, known as dense vessel sign, indicating an occluding clot. This is one of the earliest radiologic signs of acute ischemic stroke.<sup>1</sup> CT perfusion (CTP) is a contrast-enhanced imaging technique used to differentiate salvageable ischemic tissue (penumbra) from irreversibly damaged tissue (infarct core). This distinction guides treatment decisions. CTP generates perfusion maps including mean transit time (MTT), cerebral blood flow (CBF), and cerebral blood volume (CBV).<sup>2</sup>

MTT represents the average transit time of blood through brain tissue and is prolonged in both infarct core and penumbra. CBF represents the rate of blood flow through the brain tissue, which is reduced in the infarct core and penumbra. CBV represents the volume of blood within a given amount of brain tissue. It differentiates between core and penumbra: it is decreased in infarct core but preserved or increased in the penumbra.<sup>2</sup>

In this case, prolonged MTT, reduced CBF, and preserved CBV indicate penumbra without infarct core.

The patient underwent intravenous thrombolysis followed by successful endovascular thrombectomy. CTA and fluoroscopy revealed a predisposing structural abnormality for thrombus formation: a carotid web in the common carotid artery. A carotid web is a rare variant of fibromuscular dysplasia, characterized by hyperplasia in the internal carotid artery and/or the common carotid artery, creating turbulent flow and predisposes patient to thromboembolism.<sup>3</sup>

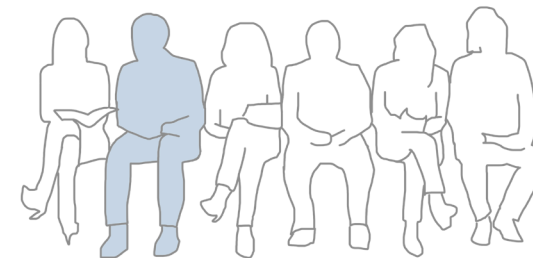
To reduce recurrence risk, an endovascular stent was placed.

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## MEET OUR TEAM

### Serhat, General Board Member



I first became familiar with AMSJ when I came across their journals in the medical library. Seeing a platform where medical students publish their own work immediately sparked my interest. It felt like a unique opportunity to combine my passion for medicine with scientific writing and research.

Within AMSJ, I serve as a General Board member. My responsibilities include organizing events, workshops, distribution, and symposia. I have contributed to organizing the “How to Write Your Thesis” workshop, and I am currently involved in organizing the Nicolaes Tulp Symposium, where we aim to bring together students and professionals to share knowledge and foster academic curiosity.

My experience within AMSJ has been very valuable. It has allowed me to develop not only organizational and communication skills, but also a deeper understanding of the academic and research landscape. I believe AMSJ plays an important role in lowering the threshold for medical students to engage in research and publication. It offers a supportive environment where students can develop themselves academically.

In the future, I would like to see AMSJ grow further as a national platform, with more collaborations and educational events. Additionally, I believe there is great potential for the development of similar student-led journals in other cities, creating a broader network in which students across the country can contribute, collaborate, and share knowledge. In this way, AMSJ could play a leading role in inspiring and connecting a new generation of student researchers.



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