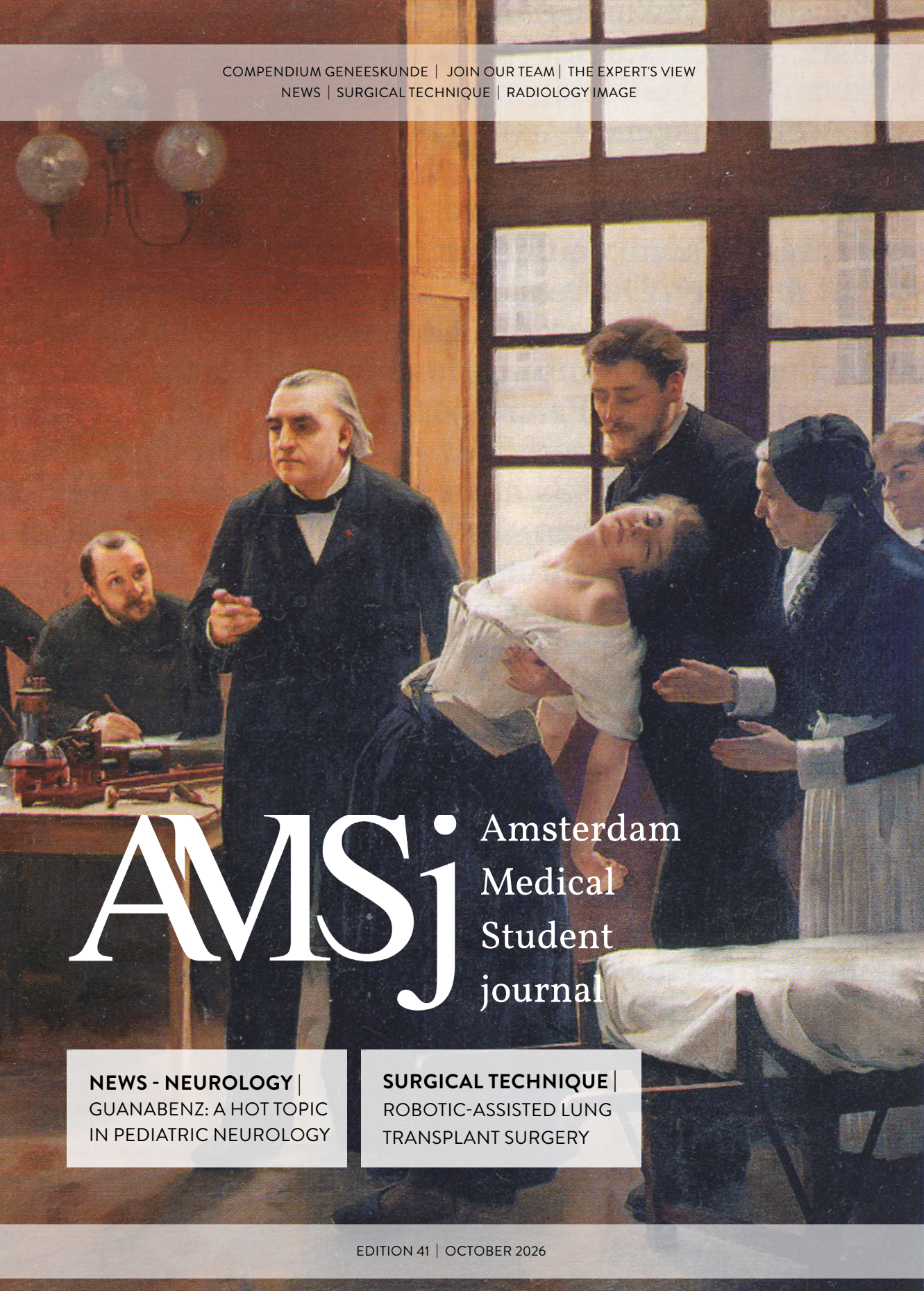
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AMSj Amsterdam Medical Student journal

NEWS - NEUROLOGY | GUANABENZ: A HOT TOPIC IN PEDIATRIC NEUROLOGY

SURGICAL TECHNIQUE | ROBOTIC-ASSISTED LUNG TRANSPLANT SURGERY

EDITION 41 | OCTOBER 2026

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AMSj

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Editorial

Dear readership,

As autumn begins and a new academic year gets underway, it is a good time to remember that scientific discoveries can start with an unexpected sight. In 1928, Alexander Fleming returned to his laboratory and noticed that a patch of mould had stopped bacteria from growing on a Petri dish. What could have looked like a spoiled experiment became the starting point for the discovery of penicillin.

That spirit of that curiosity runs through this edition and takes us from one scienitif discovery to another. Could a familiar blood-pressure drug slow the progression of a rare brain disease in children? Might gene therapy one day treat the underlying cause of hypertrophic cardiomyopathy? Our contributors explore these possibilities while keeping an eye on the questions that still need answering.

And when a new technology looks impressive, does it always make medicine better? In "False Innovation," Prof. Dr. Marcel Levi gives robotic surgery a timely reality check: are patients benefiting from the technology, or are we simply dazzled by the machinery? Furthermore, Rahul Bhoera takes readers inside the actual practice of robotic surgery: lung transplantation.

As we go through the academic year, I want to give thanks to all our student reviewers, staff reviewers, editors, and General Board members for the time and care you have contributed to this edition. We hope these articles spark curiosity, encourage critical thinking, and offer something valuable to readers across all medical years.

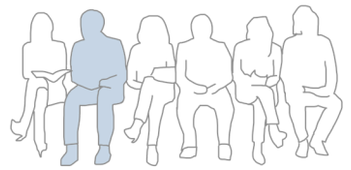
Enjoy the 41st edition of AMSj.

Yours sincerely,



Yassmina Derraze
Student Editor-in-Chief
Amsterdam UMC,

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Applications are open for 3 positions:
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WHAT'S NEW

NEUROLOGY

Guanabenz: a Hot Topic in Pediatric Neurology

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Vanishing white matter disease (VWM) is a rare genetic disorder, affecting mostly young children, in which damage to the brain's white matter leads to a rapid decline in neurological functions and early death. In this disease a genetic defect results in a dysregulated stress response for which no treatment was available thus far. A recent phase 1/2 trial published in The Lancet Neurology by the Amsterdam Leukodystrophy Center showed the course of VWM can be positively changed by the drug guanabenz.

This antihypertensive drug was given to 33 children with VWM. Guanabenz prevents the stress response underlying the white matter damage. The aim of the study was to get an assessment of the safety, tolerability and efficacy of the drug in young children with VWM. The treated children were compared with a group of 66 untreated children during a course of four years (2021-2025). Time to loss of walking with support was used as the primary efficacy outcome.

It was found that the risk of losing the ability to walk with support was 21% in the treatment group after four years compared to 44% in historical controls. During these four years, none of the treated died compared to the 5 untreated in the control group. Furthermore, MRI scans of treated children showed less worsening of white matter. Subgroup analysis showed the drug had a more positive effect in children who had an onset at the age of 3 and later.

The researchers concluded that guanabenz is safe and tolerable for children with VWM. Although in this trial guanabenz has a positive effect on the course of VWM, researchers underline the importance of a long-term follow-up study to get better understanding about guanabenz modifying VWM. Nevertheless, this trial has given us more optimistic insight in treatment for children with VWM.

1. Van Der Knaap, M.S., Verbeek, R.J., Van Voorst, R.J., et al. 2026. Safety and efficacy of guanabenz in early-childhood onset vanishing white matter: primary analysis of a single-arm, phase 1/2 trial. The Lancet Neurology 25, 818-829.

ENDOCRINOLOGY

Continuous glucose monitoring in type 2 diabetes

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2 Department of Internal Medicine, Endocrinology, Amsterdam UMC, location VUmc

Despite novel non-insulin therapies for type 2 diabetes, including SGLT2-inhibitors and GLP-1 receptor agonists, many patients remain above glycemic targets and rely on self-monitoring of blood glucose (SMBG). While continuous glucose monitoring (CGM) is widely validated for type 1 diabetes and insulin therapy, its value for patients type 2 diabetes treated with basal insulin and non-insulin therapies remain unclear.

To address this, Wilmot et al. conducted an open-label randomized controlled trial in the UK, assigning these patients to real-time CGM (n=198) or SMBG (n=105). During weeks 1 - 16, monitoring data guided self-management with basal insulin self-titration. During weeks 17 - 32, clinicians could initiate additional therapies in line with national guidance. At week 16, HbA1c decreased from 8.8% to 8.0% with CGM versus 8.7% with SMBG (adjusted difference -0.6%; 95% CI -0.8 to -0.3; p<0.0001). At week 32, HbA1c was 7.8% versus 8.3% (adjusted difference -0.5%; 95% CI −0.7 to -0.2; p<0.0001). Prandial insulin was initiated more often with CGM (13% vs. 3%; OR 4.64; 95% CI 1.35 - 15.91).[1]

These findings highlight that CGM can improve glycemic control versus SMBG in patients with type 2 diabetes on basal insulin plus non-insulin therapies through self-management and under clinician-supported management.

1. Wilmot EG, Moore P, Sathyapalan T. et al. *Continuous glucose monitoring versus self-monitoring of blood glucose in individuals with type 2 diabetes: a randomised, multicentre, open-label, superiority trial.* The Lancet Diabetes & Endocrinology. 2026 Jun 1;14(6):463–74.

DERMATOLOGY

Targeting Dermatomyositis

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2 Resident, Department of Dermatology, Amsterdam UMC, Location AMC

Dermatomyositis is a rare autoimmune disease characterized by inflammation of the skin and muscles.

Cutaneous manifestations can be persistent, pruritic, and disfiguring, with a substantial impact on quality of life. Despite treatment with systemic corticosteroids, immunosuppressants, and intravenous immunoglobulin, achieving sustained control of skin disease remains challenging.

A recent study published in *JAMA Dermatology (2026)*[1] investigated the effects of **brepocitinib**, an oral selective TYK2 and JAK1 inhibitor, on cutaneous disease activity in adults with dermatomyositis. The study was a prespecified secondary analysis of the phase 3 VALOR randomized controlled trial, including 241 patients with active skin and muscle disease. Patients received once-daily brepocitinib 30 mg or placebo for 52 weeks.

Brepocitinib significantly improved cutaneous disease activity compared with placebo, with treatment effects already evident after four weeks. At week 52, 61.7% of patients receiving brepocitinib achieved a clinically meaningful improvement in skin disease, compared with 44.3% receiving placebo. Brepocitinib also reduced pruritus and improved skin-related quality of life. Notably, 43.5% of patients with moderate-to-severe skin disease achieved functional skin remission, compared with 20.8% receiving placebo.

These findings are important because dermatomyositis has historically been difficult to control, particularly its cutaneous manifestations. The results suggest that targeted inhibition of TYK2 and JAK1 may provide rapid and sustained disease control while potentially reducing patients' reliance on corticosteroids.

For medical students, this study illustrates how understanding cytokine signalling pathways can translate into targeted therapies and highlights the growing role of precision immunology in dermatology.

1. Mangold, A. R., Haemel, A., Shahriari, N., Chong, B., Fernandez, A. P., Fiorentino, D., Pearson, D., Sluzevich, J., Onajin, O., Rambhatla, P. V., Rashighi, M., Hurabielle, C., Fivenson, D., Boh, E., Paravar, T., Crew, A., Flowers, R. H., Taylor, D., Subhardashani, S., . . . Werth, V. P. (2026). Skin-Specific Outcomes of Brepocitinib in Patients With Dermatomyositis. JAMA Dermatology. https://doi.org/10.1001/jamadermatol.2026.3199

TRAUMA

Whole blood in prehospital trauma care

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Blood loss is a major preventable cause of death after trauma, making blood transfusion crucial in emergency care[1]. Blood transfusion is given as blood components, however whole blood is rising in popularity recently. Whether whole blood transfusion is more beneficial to mortality than transfusion with components remains uncertain.

The New England Journal of Medicine published a study covering the subject in May 2026, in which Sperry et. al investigated whether whole blood transfusion is more beneficial than using blood components and storage time relevance.

Sperry et. al conducted a pragmatic cluster-randomized trial comparing patients receiving up to 2 units of low-titer group O whole blood to patients receiving red blood cells, plasma or both during prehospital resuscitation. Among 993 patients who participated, 695 were assigned to the whole blood group and 298 to the component group. Mortality rates were assessed after 30 days, which resulted in 25.9% and 20.5% respectively. The observational substudy found that 30-day mortality was 27.1% with blood stored for 15-21 days and 26.5% with blood stored for 1-14 days[2]. Both studies found no significant benefit of using whole blood over blood components for prehospital transfusion.

Prehospital resuscitation and military blood-supply planning often face blood storage challenges. Using whole blood for transfusions is often preferred because it has all three blood components and stable shelf-life. This study by Sperry et al. can thus contribute to reducing mortality rates, making it valuable to medicine and the scientific community.

1. Smith JE, Cardigan R, Sanderson E, et al. 2026 Mar 17. Prehospital whole blood in traumatic hemorrhage — a randomized controlled trial. New England Journal of Medicine [Internet]. 394(23):2305–16.
2. Sperry JL, Guyette FX, Cotton BA, et al. 2026 May 18. Prehospital Resuscitation with Type O Whole Blood for Trauma and Hemorrhage. New England Journal of Medicine [Internet]. 394(23):2317–28.

Robotic-assisted lung transplant surgery



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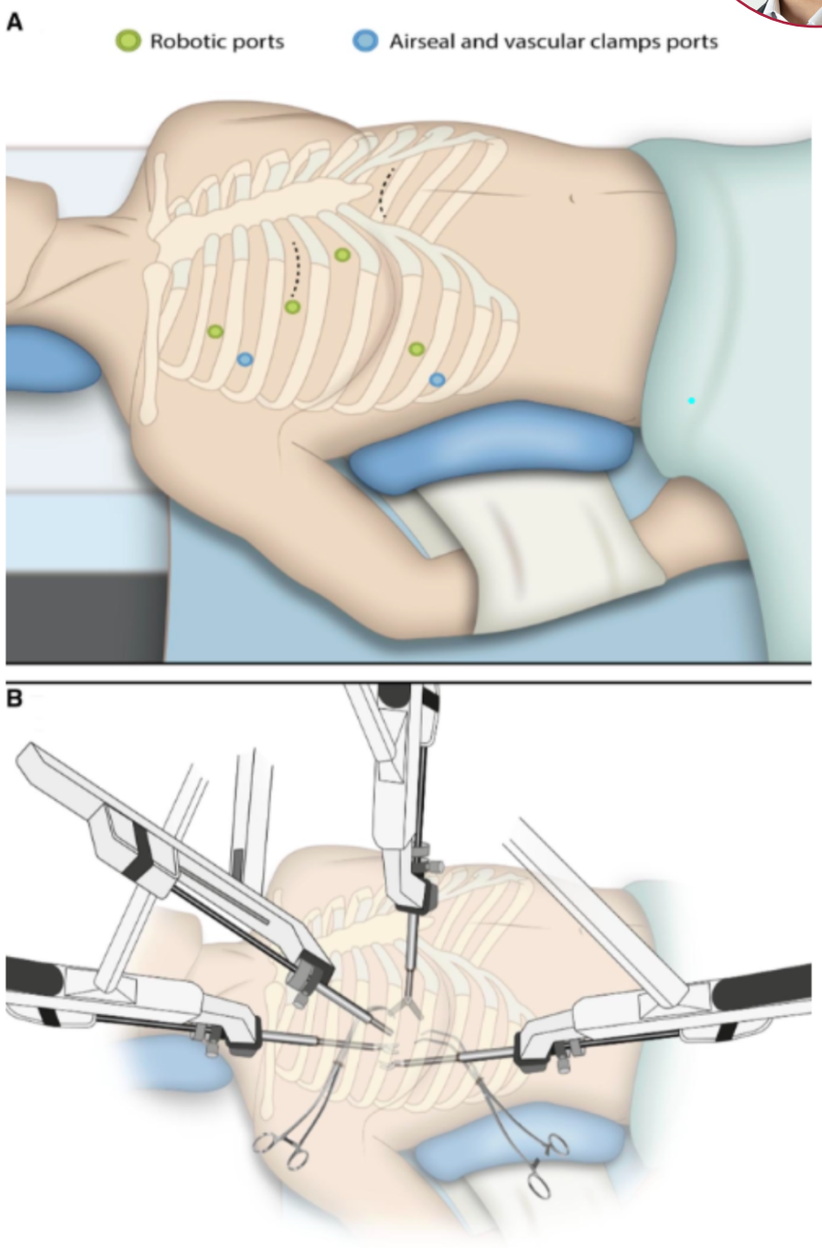


FIGURE 1 Port placement for robotic lung transplant surgery

LUNG TRANSPLANT SURGERY is the standard treatment for end-stage lung disease. High morbidity, severe postoperative pain, and significant wound complications after thoracotomy or thoracosternotomy (Clamshell incision) have given rise to investigate minimally invasive approaches[1]. Robotic-assisted surgery has transformed thoracic surgery by providing 3D visualization, tremor filtration, and wrist-like mobility within the narrow crevices of the intrathoracic anatomy[2]. Building upon these technical advantages, centers have successfully adopted robotic systems for organ transplantation. Recent clinical data demonstrate similar 1-year survival outcomes, primary graft dysfunction rates, and hospital length of stay compared to other minimally invasive approaches[3].

The success of the procedure is highly dependent on proper patient selection. Patients with chronic obstructive pulmonary disease are ideal candidates, as hyperinflated lungs create an expanded chest cavity and thus a larger working space. On the contrary, patients with pulmonary fibrosis, extensive pleural scarring or adhesions, or short stature (<160 cm) present constrained intrathoracic space and significant technical difficulty.
For robotic-assisted lung transplant surgery, the patient is placed in a supine position with semi-flexed arms. The port placement is based on the recipient pathology (e.g. 5th intercostal space camera port for COPD vs. 4th intercostal space for pulmonary fibrosis). Four robotic ports and AirSeal ports are placed alongside continuous CO2 insufflation to expand the intrathoracic space, enabling adequate instrument mobility. FIGURE 1 demonstrates the port placement for this procedure.

For the recipient pneumonectomy, hilar structures are divided using robotic or endoscopic staples, and the main bronchus is transected with monopolar scissors. The native lung is extracted through a 6-8 cm anterior thoracic or subxiphoid utility incision, avoiding rib spreading, to minimize postoperative pain.

Graft insertion is performed by introducing the fully deflated donor lung through the utility (subxyphoidal) incision. Reconstruction of the anastomoses follows a strict sequence to minimize mechanical strain on the arterial line starting with the bronchial anastomosis, followed by the atrial (venous) anastomosis and lastly the arterial anastomosis.
Antegrade reperfusion begins by de-clamping the pulmonary artery first to evacuate air before de-clamping the left atrium and securing the atrial sutures. This reperfusion occurs while the robotic system remains docked, allowing immediate placement of repair stitches if needed. To conclude the procedure, chest drains are placed through the port sites, and the incisions are closed.

REFERENCES

1. Ascanio F, Abdallah NZ, Rosado J, Sánchez L, Romero L, Jauregui A. Towards standardization in robotic lung transplants: a novel approach in minimally invasive thoracic surgery. Eur J Cardiothorac Surg. 2025;67(2):ezaf042. doi:10.1093/ejcts/ezaf042
2. Marczin N, Popov AF, Zych B, et al. Outcomes of minimally invasive lung transplantation in a single centre: the routine approach for the future or do we still need clamshell incision?. Interact Cardiovasc Thorac Surg. 2016;22(5):537-545. doi:10.1093/icvts/ivw004
3. Emerson D, Megna D, Razavi AA, et al. Robotic Lung Transplantation: Feasibility, Initial Experience, and 3-Year Outcomes. Ann Thorac Surg. 2025;119(5):1107-1116.

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False Innovation



Marcel Levi[1]
1 President Dutch Research Council (NWO) and Professor of Medicine, University of Amsterdam and University College London

INNOVATION IS THE NEW BUZZWORD THAT IS SUPPOSEDLY GOING TO SOLVE ALL OF SOCIETY'S PROBLEMS. Whether the issue is climate change, energy, productivity, housing, the environment, nitrogen emissions, or problems in healthcare: if only we innovate enough, everything will become better, easier, smarter, more efficient, and cheaper. Innovation will enable us to control rising costs and compensate for future shortages of manpower.

Of course, in itself this is of course not an unreasonable line of thinking, because technological advances, automation, and biotechnology have already brought about major improvements in all of these areas. At the same time, it is worth remembering that innovation does not happen by itself: it requires investment in research and development, as well as careful consideration of how new discoveries and technologies should be implemented. Americans call this *"false innovation."* A few years back oncologist Ezekiel Emanuel cited in *The New York Times* the **da Vinci surgical robot** as an example of false innovation. This robot assists surgeons during operations and was initially most commonly used in urological and gynecological surgery but now increasingly in all sorts of surgery. It is a flashy piece of equipment costing at least two million euros, and by now some fifty of them are gleaming away in hospitals across the Netherlands. Proud surgeons report in the media how well they are keeping up with the times by using robots in their operations, and how precise and easy it is to perform surgery with the robotic system.

> But not every technological innovation is actually an improvement.

But does this robot actually improve outcomes for patients? The medical literature reveals a startling low number of adequate scientific trials demonstrating the effectiveness of the da Vinci robot or its benefits for patients. Of more than 50.000 papers on robotic surgery in medical journals in PubMed, less than 2% deals with an adequate randomized comparison with other techniques and clinically relevant outcomes. In fact, in most of those reports, the primary outcomes tend to be whether particular procedures can be performed and how much less burdensome the operation is for the surgeon. The vast majority consist of surgeons describing their own experiences and, at best, making some comparisons with historical controls—that is, previous surgical outcomes.

All in all, there is still a striking lack of evidence that the da Vinci robot offers any meaningful benefit to patients—for example, better long-term disease outcomes, fewer side effects of surgery such as incontinence or impotence following prostate surgery, or a shorter hospital stay. And where outcomes that actually matter to patients have been assessed, there is almost invariably little or no advantage over conventional treatment. There is, however, one area in which all the studies are remarkably consistent: the costs are astronomically higher with robotic surgery.

In other words, NOT EVERY INNOVATION IS NECESSARILY AN IMPROVEMENT. Something may be new, exciting, flashy, and captivating, but that does not mean it genuinely solves a problem for people or society. Innovations that are truly useful are often slow and unglamorous, and implementing them can take an excruciatingly long time.

In any case, we need to move away from false innovations—or, perhaps more appropriately, call them "exnovations." The only way to determine whether a new invention or application represents a genuine improvement is through rigorous evaluative research. It may not be sexy or exciting, but it is absolutely crucial.

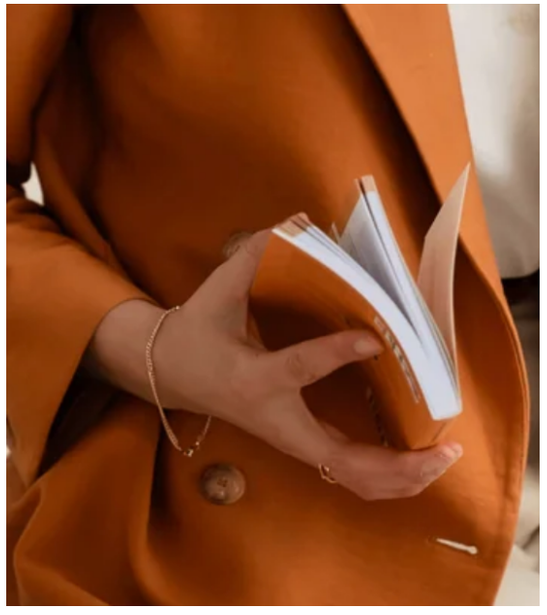
Mastering Knee Traumatology with the Orthopedic Surgery Pocketbook

Maud A.M. Vesseur[1]
1 Editor Pocket Orthopedic Surgery, Compendium Medicine
1 Resident in training at the department of Orthopedic Surgery, Maastricht UMC+

A common yet challenging presentation in the emergency department and orthopedic outpatient clinic is the acute, unstable knee following trauma. What immediate steps must be taken to systematically evaluate the joint? What differential diagnostic considerations should you keep in mind when a patient reports a sudden 'pop'? *The latest pocketbook from 'Compendium Medicine', provides healthcare professionals with a structured approach to master these clinical scenarios.*

CASE

A 24-YEAR-OLD amateur football player presents to the emergency department after suffering an unexpected valgus-external rotation injury to his right knee during a match. He heard a loud popping sensation, experienced immediate severe pain, and was unable to continue playing or bear weight on the leg. Within two hours, significant joint effusion develops. On physical examination, there is marked swelling (haemarthrosis). Specific stress testing reveals laxity on valgus testing at 20° flexion, as well as positive Lachman and anterior drawer tests. With joint line tenderness on the medial side. What is your primary differential diagnosis, and what key associated structures must be evaluated? The step-by-step diagnostic strategy and definitive management can be found in the pocketbook.



To support medical students, residents, and junior doctors in navigating musculoskeletal conditions, we developed the *Compendium Medicine Pocket Orthopedic Surgery*. Combining anatomical knowledge, clinical examination maneuvers, and diagnostic imaging, this pocketbook concisely structures all orthopedic conditions ranging from degenerative joint diseases to acute trauma. It clearly distinguishes between non-operative management and timely surgical indications. Compiled by an international team of experts and students, and enriched with practical algorithms and high-yield visual illustrations, this guide is the ideal quick reference for clinical rotations and emergency practice.

Compendium Geneeskunde

EXPLANATION & CLINICAL REASONING

Explanation: Case from Orthopedic Surgery Pocketbook

DIAGNOSIS Anterior Cruciate Ligament (ACL) rupture combined with a Medial Collateral Ligament (MCL) injury and Medial Meniscal tear, classically known as the Unhappy Triad.

MECHANISM OF INJURY

A valgus-external rotation stress applied to a flexed knee with the foot fixed on the ground is the classic traumatic mechanism for this severe injury pattern.

PHYSICAL EXAMINATION & PATHOPHYSIOLOGY

- The rapid onset of joint effusion (haemarthrosis) and an audible 'pop' strongly point toward an acute intra-articular tear, most commonly an ACL rupture.
- A positive Lachman test and Anterior Drawer test confirm anterior tibial translation due to loss of ACL integrity.
- Laxity on valgus stress testing at 20° flexion indicates secondary disruption of the MCL.
- Associated joint line tenderness and mechanical symptoms (such as locking or catching) signal concomitant medial meniscal damage.

MANAGEMENT STRATEGY

Initial management follows the RICE protocol (Rest, Ice, Compression, Elevation) to reduce pain and haemarthrosis.

In the setting of an ***Unhappy Triad***, treatment is staged:

- **MCL First:** The MCL is typically managed conservatively first using a hinged knee brace for 6 weeks to allow extra-articular healing.
- **Surgical Reconstruction:** Following MCL stabilization and recovery of joint range of motion, operative treatment (ACL reconstruction and arthroscopic meniscal repair) is indicated for active patients to restore stability and limit the long-term risk of post-traumatic osteoarthritis.

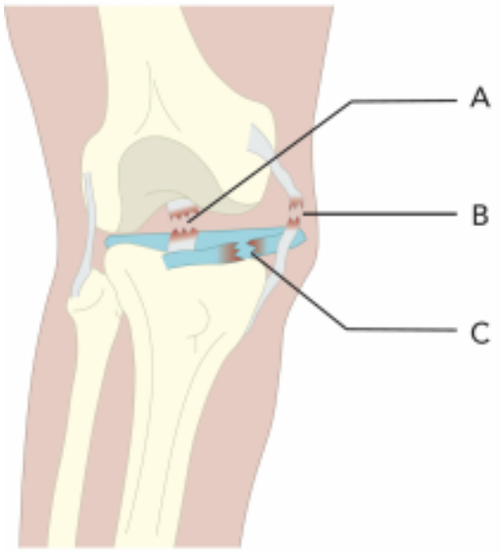


FIGURE 1 Unhappy triad

A: Anterior cruciate ligament rupture
B: Medial collateral ligament rupture
C: Medial meniscal injury

REFERENCES

1. Snijders, R., Smit, V. (2020). Pocket Traumachirurgie en orthopedie (1st ed.). Utrecht, the Netherlands: Compendium Geneeskunde, Synopsis B.V.
2. Raines BT, Naclerio E, Sherman SL. Management of Anterior Cruciate Ligament Injury: What's In and What's Out? Indian J Orthop. 2017 Sep-Oct;51(5):563-575. doi: 10.4103/ortho.IJOrtho_245_17. PMID: 28966380; PMCID: PMC5609378.
3. Hoveidaei AH, Sattarpour R, Dadgostar H, Razi S, Razi M. Unhappy triad of the knee: What are the current concepts and opinions? World J Orthop. 2023 May 18;14(5):268-274. doi: 10.5312/wjo.v14.i5.268. PMID: 37304199; PMCID: PMC10251265.

Ultrasound findings in a 14-month-old child



TESSA RUBINGH[1], MATTHIJS J. VAN EE[1], AND PROF. DR. MARIO MAAS[2]
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2 Department of Radiology and Nuclear Medicine, Amsterdam UMC

CASE

A 14-MONTH-OLD CHILD without symptoms underwent an ultrasound examination of the urinary tract. Previous imaging had shown abnormalities in the pelvic region.

QUESTION 1

Which organ is visualized, and what abnormality is present?

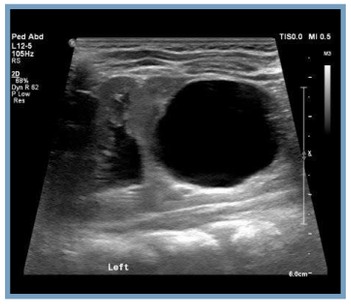
A. Kidney with hydronephrosis and a cyst
B. Urinary bladder with dilatation of the left ureter
C. Urinary bladder with wall thickening and a cyst
D. A kidney with wall thickening and hydronephrosis



QUESTION 2

What is the most appropriate description of the finding in the left kidney?

A. A simple renal cyst without involvement of the collecting system
B. A large renal cyst with associated moderate dilatation of the collecting system
C. A multicystic dysplastic kidney

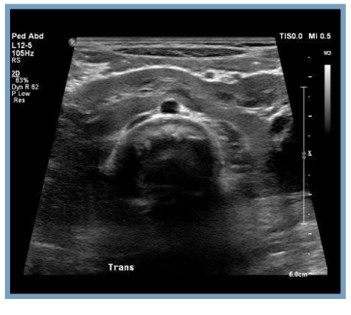


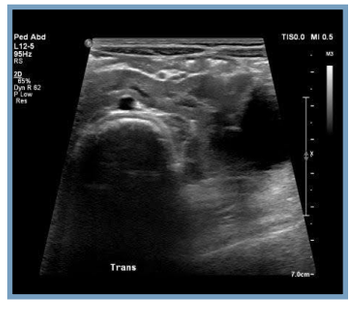


QUESTION 3

What is the diagnosis based on the ultrasound findings?

A. Horseshoe kidney
B. An enlarged right kidney representing a normal variant
C. Multicystic dysplastic kidney





Answer on page 16

Gene Therapy as a Future Treatment for Hypertrophic Cardiomyopathy: Towards Personalised Mutation-Targeted and Cardioprotective Therapies

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ABSTRACT

INTRODUCTION
Hypertrophic cardiomyopathy (HCM) is a heterogeneous disorder involving sarcomere mutations and other disease-modifying factors. Current treatments improve symptoms but do not correct pathogenic variants. This review examines whether gene therapy, alone or combined with pharmacological therapies, could become an effective future treatment for HCM.

METHODS A narrative literature review was conducted using PubMed and ScienceDirect. Twelve peer-reviewed articles on HCM mechanisms, established treatments and emerging gene therapies were selected and synthesized.

RESULTS MYBPC3 and MYH7 variants are prominent genetic causes, but genotype alone does not explain disease variability. AAV-mediated MYBPC3 replacement, including TN-201, targets a defined molecular defect. Cardioprotective approaches seek to limit fibrosis, hypertrophy and vascular dysfunction independently of mutation correction. Cardiac delivery, immune responses and limited long-term human data remain major challenges.

CONCLUSION Gene therapy may complement rather than replace conventional HCM treatment. Its clinical role requires further evidence on efficacy, safety and patient selection.

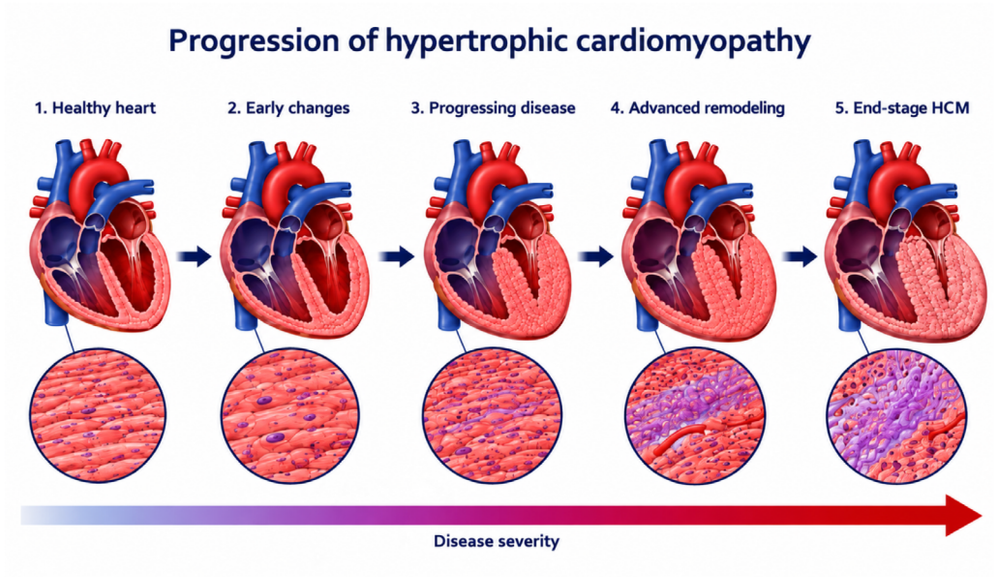


FIGURE 1 Progression of hypertrophic cardiomyopathy (HCM) from a healthy myocardium to advanced cardiac remodeling. The schematic illustrates progressive cardiomyocyte hypertrophy, myocyte disarray and interstitial fibrosis. Original author-created figure using Canva and BioRender, based on Hao et al., Chiswell et al., Desai et al., Tudurachi et al., and Maron et al.

INTRODUCTION

Hypertrophic cardiomyopathy (HCM) involves myocardial thickening, impaired relaxation and, in some patients, left ventricular outflow tract obstruction. Arrhythmias and heart failure can follow. Pathogenic variants in sarcomere genes, particularly MYBPC3 and MYH7, contribute to inherited HCM; however, phenotype varies among carriers, and some patients have no identifiable sarcomere variant.[1–4] FIGURE 1 summarizes disease progression.

Beta-blockers and calcium channel blockers relieve symptoms; septal reduction procedures address severe obstruction. Mavacamten reduces excessive myosin activity and can improve exercise capacity and obstruction in selected patients, but requires monitoring and does not repair a pathogenic gene. This review evaluates whether gene therapy, alone or combined with existing pharmacological therapies, could become an effective future treatment for HCM.

METHODS

This narrative review synthesizes the twelve peer-reviewed publications included in the original literature research. Articles were retrieved through PubMed and ScienceDirect using terms relating to HCM, sarcomere mutations, mavacamten, adeno-associated virus (AAV) delivery and gene therapy. Original research and reviews addressing disease mechanisms, established treatment or emerging therapies were included according to relevance. No systematic screening or meta-analysis was performed.

RESULTS

GENETIC HETEROGENEITY & EXISTING TREATMENT

MYBPC3 encodes cardiac myosin-binding protein C, which regulates sarcomere function, while MYH7 encodes β-myosin heavy chain, a motor protein involved in force generation.[1,2,4] Sarcomere variants do not fully predict disease severity; non-genetic influences and modifier pathways may contribute to the phenotype.3 Conventional treatment reduces symptoms or obstruction, whereas mavacamten targets hypercontractility without correcting its genetic origin.[5–8] FIGURE 2 illustrates the multifactorial disease framework.

MUTATION-TARGETED GENE THERAPY

Mutation-targeted strategies include gene replacement, editing and silencing.[9,10] TN-201 uses an AAV vector to deliver a functional MYBPC3 copy to cardiomyocytes in patients with MYBPC3-associated HCM. Early human results have been reported, but durable clinical benefit and long-term safety remain to be established.[9,11] Mutation-specific approaches may not serve patients without an identified pathogenic variant; correction may also be insufficient to reverse established fibrosis and remodeling.

CARDIOPROTECTIVE GENE THERAPY

Cardioprotective strategies instead target downstream injury, including cardiomyocyte hypertrophy and loss, interstitial fibrosis, and microvascular and endothelial dysfunction. The original literature research discusses AAV-mediated ZEB2 delivery as a proposed approach to influence pathways involved in cardiac remodeling, fibrosis, hypertrophy, endothelial function and cardiomyocyte survival. Unlike mutation-targeted gene therapy, cardioprotection does not necessarily correct a pathogenic variant. It may complement gene replacement or offer a potential strategy for patients without identifiable sarcomere mutations; its efficacy in HCM remains unproven.

DISCUSSION

The two strategies address different aspects of a heterogeneous disease: mutation-targeted treatment addresses a defined genetic cause, whereas cardioprotection aims to preserve tissue despite varied initiating mechanisms. Their combination with symptom-directed medication is biologically plausible, but superiority of combination therapy has not been demonstrated in HCM trials. AAV delivery to cardiac tissue, vector-related immune responses, durability of expression and cost complicate implementation.[10–12] FIGURE 3 contrasts these two proposed gene therapy strategies.

A strength of this review is its integration of genetic, pharmacological and gene-therapy literature. Its limitations include a narrative, relevance-based selection of only twelve publications, the mixture of reviews and original studies, and reliance on preclinical or early-phase evidence for emerging interventions. Evidence for genotype-negative patients and long-term outcomes is especially limited. Future trials should assess patient selection, clinically meaningful outcomes, safety and combinations with established treatment.

In conclusion, gene therapy offers a potential disease-modifying addition to HCM care, but current evidence does not support replacing established treatments. Mutation-specific and cardioprotective approaches warrant further evaluation in appropriately selected patient groups.

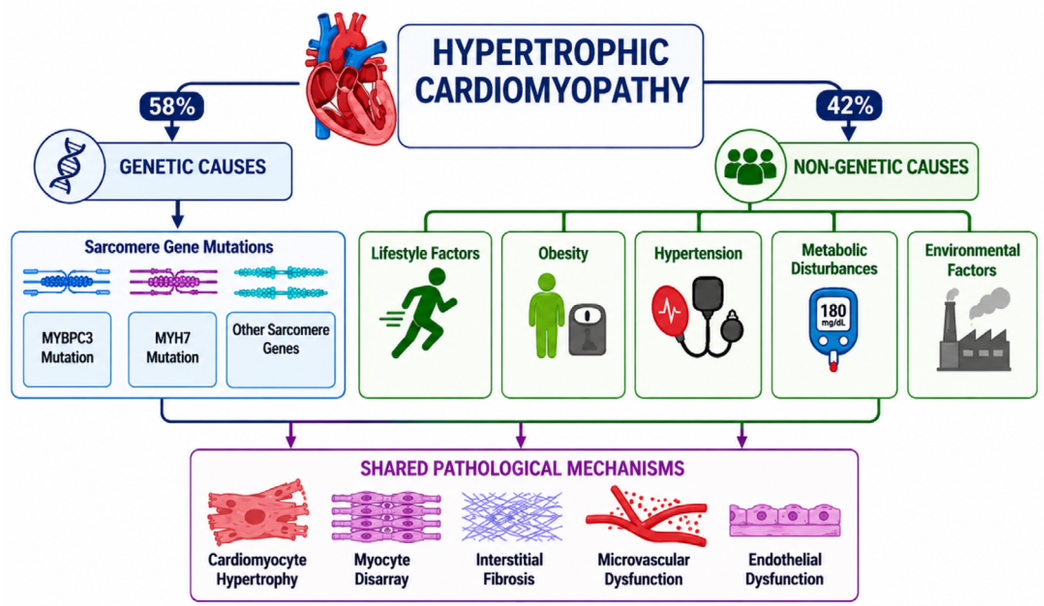


FIGURE 2 Overview of the heterogeneous mechanisms associated with hypertrophic cardiomyopathy (HCM). Sarcomere gene variants, including MYBPC3 and MYH7, and non-genetic or modifying factors may contribute to the phenotype. The percentages in the original schematic distinguish identifiable genetic findings from cases without identifiable sarcomere mutations; the latter do not necessarily have an exclusively non-genetic cause. Original author-created figure using Canva and BioRender, based on Hao et al., Chiswell et al., Tudurachi et al., and Maron et al.

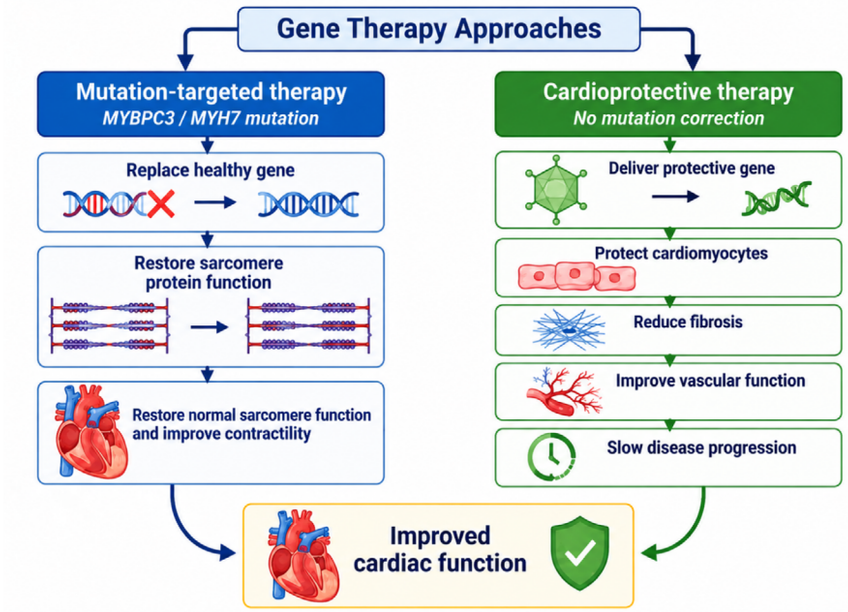


FIGURE 3 Mutation-targeted and cardioprotective gene therapy approaches proposed for hypertrophic cardiomyopathy (HCM). Gene replacement aims to restore sarcomere protein function; cardioprotection aims to limit downstream tissue injury without necessarily correcting the mutation. The illustrated improvement in cardiac function is a therapeutic goal, not demonstrated efficacy in HCM. Original author-created figure using Canva and BioRender, based on Desai et al., Paratz et al., Sharma et al., and Zhang et al.

REFERENCES

1. Hao L, Chen X, Qin B. Hypertrophic cardiomyopathy: comprehensive insights into pathogenic genes and genotype-phenotype associations. Front Cell Dev Biol. 2026;14:1741252.
2. Tudurachi B, Zăvoi A, Leonte A, et al. An update on MYBPC3 gene mutation in hypertrophic cardiomyopathy. Int J Mol Sci. 2023;24(13):10510.
3. Maron BA, Wang R, Carnethon MR, et al. What causes hypertrophic cardiomyopathy? Am J Cardiol. 2022;179:74–82.
4. Chiswell K, Zaininger L, Semsarian C. Evolution of geetic testing and gene therapy in hypertrophic cardiomyopathy. Prog Cardiovasc Dis. 2023;80:38–45.
5. Hutt E, Desai MY. Medical treatment strategies for hypertrophic cardiomyopathy. Am J Cardiol. 2024;212:S33–S41.
6. Cui H, Lai Y, Schaff HV. Septal reduction therapies for obstructive hypertrophic cardiomyopathy: current strategies and evolving innovations. Trends Cardiovasc Med. 2026.
7. Al-Horani RA, Woodland M. New era: mavacamten for obstructive hypertrophic cardiomyopathy. Cardiovasc Hematol Agents Med Chem. 2022;21(2):78–83.
8. Ismayl M, Abbasi MA, Marar R, et al. Mavacamten treatment for hypertrophic cardiomyopathy: a systematic review and meta-analysis of randomized controlled trials. Curr Probl Cardiol. 2022;48(1):101429.
9. Desai MY, Nagueh SF, Giudicessi JR, et al. First-in-human study of TN-201, an AAV9 gene replacement therapy in MYBPC3-associated hypertrophic cardiomyopathy: initial safety, pharmacodynamic, and imaging results from MyPEAK-1. Cardiovasc Res. 2025;121(17):2628–2631.
10. Sharma S, Sadasivan C, Yan Y, et al. Gene-based therapies for genetic cardiomyopathies: molecular medicine for heart disease. Can J Cardiol. 2026;42(5):1018–1039.
11. Paratz ED, Mundisugih J, Rowe SJ, et al. Gene therapy in cardiology: is a cure for hypertrophic cardiomyopathy on the horizon? Can J Cardiol. 2023;40(5):777–788.
12. Zhang H, Zhan Q, Huang B, et al. AAV-mediated gene therapy: advancing cardiovascular disease treatment. Front Cardiovasc Med. 2022;9:952755.

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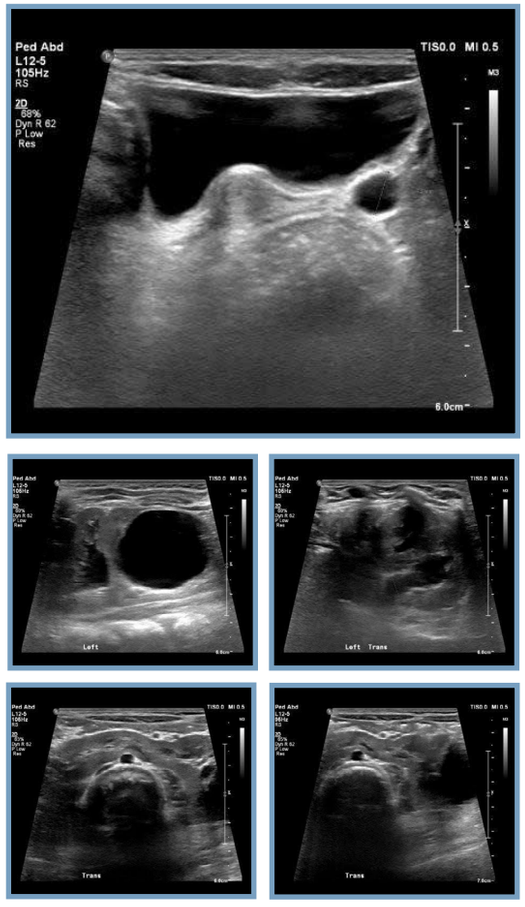
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Answers ' Ultrasound findings in a 14-month-old child'



Correct answers: 1B, 2B, and 3A

On transverse ultrasound, a horseshoe kidney appears as elongated renal parenchyma crossing the midline, with the lower poles connected by an isthmus.

A horseshoe kidney is a congenital renal fusion anomaly characterized by fusion of the lower poles of the kidneys through an isthmus. It occurs in approximately 1 in 400–600 individuals, with a male-to-female ratio of 2:1.[1]

During the fourth week of the embryological development, abnormal fusion of the kidneys may occur, resulting in fusion of the lower poles. Between the seventh and eighth week, the kidneys normally ascend from the pelvis and rotate.[1] Due to the fused isthmus, a horseshoe kidney cannot complete normal ascent, as the isthmus is restricted by the inferior mesenteric artery. Consequently, the kidneys remain lower (typically L3–L5) and are malrotated, with the renal pelvis oriented anteriorly.[1]

Approximately one-third of patients remain asymptomatic and are diagnosed incidentally.[1] Symptoms are commonly related to abnormal renal position and impaired urinary drainage. Ureteropelvic junction (UPJ) obstruction is the most common complication, occurring in up to one-third of patients. Other complications include infections, nephrolithiasis, an increased risk of certain malignancies, including Wilms tumor, and traumatic injury due to the renal position.[1-2]

Horseshoe kidney is associated with other congenital anomalies and genetic syndromes. 1 It occurs in approximately 60% of patients with Turner syndrome. [2] Other associated abnormalities include cardiovascular defects, such as ventricular septal defects, and urogenital anomalies, including obstructed hemivagina and ipsilateral renal anomaly (OHVIRA) syndrome. [1-2] Therefore, ultrasound evaluation of the uterus is indicated in female patients with congenital renal anomalies and vice versa.

OHVIRA syndrome is characterized by a triad of findings: uterine didelphys, obstructed hemivagina, and ipsilateral renal agenesis.[3] Patients typically present after menarche with progressive pelvic pain and dysmenorrhea due to accumulation of menstrual blood within the obstructed hemivagina. Treatment consists of surgical resection of the obstructing septum. The didelphys uterus does generally not require surgical correction, as both uterine cavities are functional. [3-4]

REFERENCES

1. Shah HU, Ojili V. Multimodality imaging spectrum of complications of horseshoe kidney. Indian J Radiol Imaging. 2017 Apr-Jun;27(2):133-140.
2. Je BK, Kim HK, Horn PS. Incidence and Spectrum of Renal Complications and Extrarenal Diseases and Syndromes in 380 Children and Young Adults With Horseshoe Kidney. AJR Am J Roentgenol. 2015 Dec;205(6):1306-14.
3. Sijmons A, Broekhuizen S, van der Tuuk K. OHVIRA syndrome: Early recognition prevents genitourinary complications. Ultrasound. 2023 Feb;31(1):61-64.
4. Bonetti E, Anderson G, Duranti S. Clinical features and surgical options of obstructed hemivagina and ipsilateral renal agenesis (OHVIRA) syndrome: A systematic review and a meta-analysis of prevalence. Int J Gynaecol Obstet. 2025 Oct;171(1):152-164.



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ISSN 2589-1243 (print); 2589-1251 (online)

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The Clinical Lesson at the Salpêtrière, 1887

This painting by André Brouillet depicts an imaginary scene of one of the legendary 'Tuesday Lessons' at Pitié-Salpêtrière Hospital in Paris, where French neurologist Jean-Martin Charcot (1825-1893) delivered a clinical lecture and demonstration on hysteria. Among the pupils gathered around the founder of modern neurology are his notable heirs, including Joseph Babinski, Georges Gilles de la Tourette, and Paul Richer.