Real-world experience with Thopaz+

The Oxford University Hospitals NHS Foundation Trust experience

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Introduction

Foreword

Chest drains have long been used to manage accumulations of air or fluid in the thoracic cavity following chest surgery, trauma and conditions such as pneumothorax, and chest drainage systems have changed little for decades. The Thopaz+ digital drainage system has emerged as a significant advancement in chest drain technology, with far-reaching implications for clinical practice. **This report describes our first-hand experience** with this device **in various medical departments** at Oxford University Hospitals NHS Foundation Trust since the initial introduction of its predecessor Thopaz to cardiothoracics in 2012.

At the heart of the Thopaz+ system lies its capacity for **objective and continuous monitoring** of air leaks and fluid drainage, heralding a paradigm shift in patient care. Real-time data on intrathoracic pressure and fluid output empowers healthcare professionals (HCPs) with actionable insights, fostering precision and timeliness in medical interventions. This has been particularly invaluable in the cardiothoracic and respiratory departments at Oxford University Hospitals NHS Foundation Trust, where meticulous post-operative recovery and fluid management are paramount.

Efficiency and patient safety of medical procedures are cornerstones of patient care. Through precise monitoring and regulated pressure settings, the system facilitates expedited fluid evacuation, culminating in shorter drainage periods and accelerated patient recovery. This efficiency has been a boon across all of our departments, but particularly in paediatrics, where minimising discomfort and distress is paramount. Furthermore, by mitigating the risk of complications such as air leaks and infections, the Thopaz+ system facilitates a safer treatment environment, which has been especially crucial in our trauma, critical care and intensive care departments. Reduced complications and expedited management of drainage have directly contributed to shortened hospital stays, thereby enhancing patient satisfaction and optimising bed utilisation in resource-constrained settings such as critical and intensive care.

Francesco Di Chiara MD, MS Thor(Hons), FEBTS
Consultant Thoracic Surgeon
Oxford University Hospitals NHS Foundation Trust

The Thopaz+ system's user-friendly design and reliable performance streamline workflows, empowering HCPs to focus on patient care. Testimonials from diverse departments in Oxford, including cardiothoracics and respiratory, underscore the system's efficacy in simplifying daily routines and enhancing staff satisfaction. Successful integration of the Thopaz+ system is underpinned by comprehensive training sessions and ongoing technical support. These resources ensure proficiency in system utilisation, fostering better patient outcomes and sustaining operational excellence.

The patient should be the central focus of healthcare delivery, and the Thopaz+ system enhances the patient journey by minimising discomfort and offering a non-intrusive treatment experience. The system's quiet operation and portable design resonate particularly strongly in departments such as paediatrics and trauma, elevating overall patient satisfaction during hospital stays.

Although initial investment in Thopaz+ may appear significant, the accrued long-term cost benefits are likely to be substantial. Reduced complications, shorter hospital stays and heightened efficiency can yield significant cost savings, ultimately justifying the initial expenditure.

Overall, our experience at Oxford University Hospitals NHS Foundation trust has shown that Thopaz+ is an indispensable asset for HCPs, redefining standards of care and operational efficiency across multiple medical departments. We encourage all units using chest drains to consider making the move from underwater seal drains to Thopaz+ in the vast majority of patients requiring chest drainage.

About this report

Thopaz+ is a portable digital chest drainage and monitoring system developed by Medela. Thopaz+ offers continuous objective monitoring of air leaks and fluid output, which facilitates assessment of patients' progress, as well as standardisation of chest drainage management across different departments.[1] Clinical evidence has demonstrated that Thopaz+ is a useful tool in the management of patients undergoing chest surgery, has clear clinical advantages compared with underwater seal drains using wall suction, and can be used to assess air leaks as the sole criteria for drain removal after pulmonary resection.[1–3]

Thopaz+ and its predecessor Thopaz have been in use within the Cardiothoracic Department at Oxford University Hospital NHS Trust since 2012. A report on the experience with Thopaz/Thopaz+ contributed to the original National Institute for Health and Care Excellence (NICE) Medical Technology Guidance 37 on this device published in 2018.[1,4] Use of Thopaz+ in Oxford has since expanded to other departments within the trust.

This report describes the broader experience with Thopaz+ since the original report.[4] It is based on interviews with a number of healthcare professionals at Oxford University Hospital NHS Trust in February and March 2024, which were facilitated by HSJ Advisory.

The report has been written by HSJ Advisory on behalf of Medela, reflecting the views expressed in the interviews. Medela Surgical Care funded the project and had input into the development of the report.

Use the interactive menus in the top and side bars to explore different topics, which are colour coded as below. The appendices include guidance on chest drains and information on Thopaz+.

How it all started

How it all started

The cardiothoracic ward at John Radcliffe Hospital, Oxford University Hospitals NHS Foundation Trust, originally used underwater seal drains for patients after thoracic surgery.[4] After a consultant with experience of Thopaz in another hospital joined the department, this digital drainage system was adopted in 2012.[4]

The initial business case for use of Thopaz was based on the consultant's experience that Thopaz offered better management of air leaks, more accurate assessment of air leak, and safe earlier mobilisation facilitated by accurate portable suction.[4] Despite a cost for Thopaz devices, its use was supported by the fact that consumables were cheaper than the underwater seal drains used at that time.[4] Thopaz was initially used on the cardiothoracic ward at John Radcliffe, where it is used for all patients who have thoracic surgery and require a chest drain postoperatively (excluding patients who have had pneumonectomy).[4]

A second business case for adoption of Thopaz+ in 2018 was supported by the data and information gathered with initial use of Thopaz, which showed reduced length of stay compared with underwater seal drains and earlier mobilisation of patients following surgery, which allows them to walk around, go to the toilet and attend X-rays without a ward nurse escort.[4]

Consequently, in March 2018, the trust purchased 15 Thopaz+ devices for the cardiothoracic ward and two Thopaz+ devices for the respiratory ward for selected patients, including those with pneumothorax.[4]

The implementation process and findings from initial use of Thopaz and subsequently Thopaz+ have previously been reported in a contribution to NICE medical technology guidance 37.[4]

Key findings from the initial report were:[1,4]

- Thopaz+ digital chest drain devices provided more objective information for managing patients (3 days' worth of data on air leak and fluid output) than the previously used underwater seal drains.
- Nurses found reading the result on the digital screen easier than trying to count bubbles.
- Patients can see improvements in their condition from the readings.
- Patients could mobilise earlier following surgery, which means they could be taken to X-ray without a nurse escort, freeing up nursing time for the ward.

Current use

EVOLUTION OF THOPAZ+ USE IN OXFORD

DRAINAGE PROTOCOLS

COST AND ACCESS

Evolution of Thopaz+ use in Oxford

2012 — Cardiothoracic department

2013
2014
2015
2016 — Respiratory medicine

2017
2018
2019 — CCU/ICU; Trauma

2020 — Gastroenterology

2021
2022 — Paediatrics; Neurosciences

2023/2024 — Additional departments being evaluated

Since the initial introduction of Thopaz/Thopaz+ by the cardiothoracic department, use of Thopaz+ has spread to other departments treating patients who need chest drains.

Click the to view details.

Drainage protocols

Each department has its own protocol for use of chest drains. The protocol in place will depend on whether they have switched to Thopaz+ as the default or are still using a mix of Thopaz+ and underwater seal drains. Protocols specify when Thopaz+ should or should not be used and if active suction is required. Although some protocols recommend digital devices, this is not always possible if the department fleet has insufficient devices for demand.

Consideration

Access to Thopaz+ can be limited by availability of devices in department fleets. However, departments already using Thopaz+ see the benefits and are purchasing new devices.

In some cases where Thopaz+ would clearly be beneficial but the fleet is all in use or not available in a service, devices are loaned between departments. Where teams are using Thopaz+ but one is not available, they will seek a spare device or check if a patient still requires a device to avoid starting new patients on an underwater seal drain and returning to relying on subjective measurements.

If departments are running both underwater seal drains and digital devices, there can be confusion around the practicalities of setting up and use when switching between the two types of device.

Cost and access

Thopaz+ devices require an initial investment and can initially be more expensive when just comparing acquisition costs with underwater seal drains. Some departments have used charitable funding to purchase devices.

> *"There are a number of ways to recoup the costs: efficiencies in the system, less litigation because things don't go wrong, staff sickness due to back injuries, and length of stay if you can get patient home quicker."*

> *"We don't have enough of them at the moment, but we just put a bid in for some more. They're a fairly expensive product, but you can't worry too much about that when you've got the safety of the patient at the end of the day."*

Health-economic analysis

A recent evidence-based practice project in the United States of America found that the "employment of a digital air leak detection device in patients who have undergone pulmonary lobectomy can remove interobserver variability and lead to quicker recognition of air leak cessation, earlier chest tube removal, a decrease in hospital length of stay (LoS), and a lowering of overall costs". Alone in this area, this led to cost savings of $2,659 per hospital day.[5]

Clinical experience

Objective and continuous monitoring

The objective and continuous monitoring provided by Thopaz+ has transformed practice in terms of decision-making.

Interpersonal variability in subjective estimates of leakage with underwater seal drains introduces ambiguity. Previously, healthcare professionals (HCPs) would ask patients to cough and breathe deeply and then assess how much bubbling was created by looking at a snapshot view of the chest drain, which was imprecise and subjective.

Thopaz+ removes subjectivity and variability, with the exact amount of air and fluid leakage useful for clinicians in determining how to proceed with further management, for handover between shifts, and for early discharge planning.

Interobserver variability[6]

Management of pulmonary air leak is a significant clinical challenge. Analogue pleural drainage systems require the observer to visually detect if a pulmonary air leak is present and determine the size of the air leak according to an analogue scale (1+ to 7+). This is often based on counting of the number of bubbles. Bedside assessment of air leak severity therefore is an error-prone task with a significant degree of variability between different observers. Inherent limitations of analogue pleural drainage systems may be contributing factors to this problem. Digital pleural drainage technology improves the agreement level between members of the healthcare team when assessing the severity of a pulmonary air leak after lung resection.

> *"It's very useful to know that the interventions we're using are or are not working... So it's a very useful daily or 4-hourly clinical parameter for the progression of the patient alongside other parameters such as the oxygen level and the chest X-ray and so on"*

> *"Measurement of air leak is very, very helpful for us in a very precise way."*

Improved decision-making

The values Thopaz⁺ displays provide vital information for clinicians to guide decision-making.

- A reduction in leakage from 1,000 ml/min to 300 ml/min shows objective progress.
- If an air leak in a patient with spontaneous pneumothorax is not reducing to <200 ml/min after 48 hours, the pneumothorax is unlikely to resolve on its own and referral to a thoracic surgeon may be needed.
- If an on-call clinician is contacted about a leak of 300 ml/minute overnight, it provides an objective measure to decide whether intervention is needed compared with a subjective description of "the patient has bubbles".
- If a patient has a downward trend of air leak reading leading to low ml/min within 2 hours of surgery, a specialist can begin to make plans for morning discharge the following day rather than waiting to review in the morning and then make plans.
- Thopaz⁺ facilitates same-day discharge for some patients who have undergone surgery. X-rays cannot confirm the persistence of air leaks, but Thopaz⁺ placed for 30 minutes can confirm whether an air leak is still present, providing an objective measure that allows the drain to be removed and the patient to be sent home within 2–3 hours of completing a procedure.

> *"An on-call HCP unfamiliar with Thopaz⁺ might not understand the implications of a particular value and know when to call for support; however, familiarity will improve as experience with Thopaz⁺ broadens."*

> *"Thopaz⁺ has two great abilities. One is the deliverability of suction in a reliable fashion, in an ambulatory fashion, and that's good. The other is the accurate measurement of air leak. We use it differently in different circumstances – sometimes measurement of the air leak is our priority and sometimes the priority is use of suction."*

Patient safety

Thopaz+ is a closed system, which reduces the potential for incidents, errors and accidental mishaps. As Thopaz+ is a dry system, it avoids incidents that can happen with underwater seal drains – such as water not being added or the device being raised above chest level. Thopaz+ avoids leakage related to changing bottles that occur with underwater seal drains. If Thopaz+ is knocked over when patients are rolled or moved or during personal care activities, non-medical staff can manage these incidents without impact on the patient.

Consideration

As with underwater seal drains, disconnections by patients can happen. However, Thopaz+ will sound an alert should this happen.

> *"Safety and efficiency [are] the two [main differences] for the patient journey between conventional chest drains and digital systems such as Thopaz+."*

Complications with wall suction used with underwater seal drains are common. Wall suction can become displaced or unclip from the wall. The level of suction can be set too strong if the HCP does not know how to use the wall regulator: Thopaz+ pressure settings are limited to –70 cmH_2O, while pressure from wall regulators can go higher. Disruption to wall suction can result from blockages if filters get wet. Wall suction is increasingly unreliable as pressures on the NHS reduce funding and resources for repairs and regular maintenance. Thopaz+ provides its own suction source and so avoids these issues.

Thopaz+ is associated with fewer infections, due to it being a closed system, whereas underwater seal drains have open areas that introduce a risk of infections if not properly managed.

> *"We use digital suction…because it's much more reliable, it's much more consistent and it's much safer. I'm very happy that it's better than wall suction."*

OBJECTIVE AND CONTINUOUS MONITORING
IMPROVED DECISION-MAKING
PATIENT SAFETY
MOBILISATION
DURATION OF DRAINAGE
LENGTH OF STAY
PATIENT JOURNEY

Mobilisation

Immobilisation of patients is a significant issue postoperatively, especially in elderly patients and those at risk of deep vein thrombosis.

Early mobilisation has been linked to reduced risk of postoperative complications, shorter hospital stays and faster overall recovery times. Overall, it plays a critical role in promoting physical and psychological wellbeing after surgery, facilitating quicker return to independence and normal functioning. This allows patients to return to their normal activities and routines sooner and is aligned with Enhanced Recovery After Surgery (ERAS).[7] Thopaz+ can be operated fully portable for up to 10 hours on battery, allowing patients to freely and easily mobilise without the limitation of wall suction.

> *"[Thopaz+] makes patients mobile quicker, so their risk of developing other complications of being in bed is reduced."*

Duration of drainage

It is difficult to estimate the impact of Thopaz⁺ on duration of drainage in routine clinical practice due to large variations – even within a department – depending on why the chest drain is required and complications that develop. However, Thopaz⁺ removes the guesswork from when to remove the drain and so can facilitate earlier removal.

> *"In pleural disease, the ml volume collection is really fabulous for us. We get very accurate amounts of how much drainage has come out in the last 12 hours, last 24 hours. That's very helpful for us."*

> *"More [underwater seal drains] were taken out a little bit prematurely, with reinsertion of chest drains, but I don't see that happening now."*

Consideration

The trend in pleural disease over the past 20 years has been to use smaller bore chest tubes (≤14 French) because they are less painful. In case very small chest tubes are used, a clamping trial is undertaken, in which the drain is clamped for 2 hours, x-ray repeated and the clamp removed to restart suction to check if there is a small pneumothorax. Overall, reinsertion rates are lower because of a reduction in 'guesswork' with the digital system.

Length of stay

The NHS has encouraged procedures to be performed as day cases where possible. Digital drainage can facilitate this, as the reliability of detection and objective measurements give HCPs confidence that their patients do not have persistent air leaks.

Length of stay was reduced in patients in the cardiothoracic department in the interim analysis of 2018.[1] It is more difficult to judge this in current clinical practice, as Thopaz$^+$ is used in the vast majority of patients and so there are few data for comparison.

In the respiratory department, Thopaz$^+$ reduces length of stay of day-case procedures by at least 4 hours and potentially up to a full day, with about 70% of patients who have a pleural intervention and about 60% of those undergoing thoracoscopy returning home on the same day. For patients admitted to the respiratory unit, Thopaz$^+$ is unlikely to reduce length of stay for those undergoing pleurodesis; however, it results in a saving of one day per patient with pneumothorax.

> *"From the day-case unit, if it was a conventional drain, maybe 30% would end up on the ward while we're waiting to prove that they don't have an air leak, whereas with the digital drain that goes down to 0%, I would say."*

In the CCU, length of stay is about 10 days with underwater seal drains compared with 7 days using Thopaz$^+$. The impact of Thopaz$^+$ on length of stay is difficult to gauge in patients in ICU, as the length of stay is extremely variable due to multiple variables and complex problems in critically ill patients. The impact of Thopaz$^+$ on length of stay in paediatrics is also unclear, as drains typically only stay in place for 24–48 hours; however, accurate measurements provided by Thopaz$^+$ facilitate a clear plan for discharge. Patients are not discharged to home with Thopaz$^+$ devices.

> *"From the NHS perspective, I think it probably allows us to make earlier decisions about withdrawing chest drains and getting people out of hospital earlier."*

Patient journey

Thopaz⁺ can be used throughout a patient's journey, which can reduce the possibility of issues and errors, because whenever a device is changed, drains can become kinked or displaced.

The process for switching an underwater seal drain from providing simple drainage to providing suction when required later is complex, requiring connection with a wall unit and a vacuum regulator to be set up. In comparison, if suction is required after a Thopaz⁺ device has initially been set up to provide straightforward drainage, this can be added by pressing a button to initiate suction via the device itself without having to connect to a wall suction unit.

Postoperatively, Thopaz⁺ reduces the need for most patients to be transferred to ICU – Thopaz⁺ is fitted in theatre and patients are transferred straight to the ward.

> *"It possibly allows earlier treatment decisions, which I think patients would be on board with, and it gives us more information on their disease trajectory, which patients are also on board with."*

Table 1. Examples of benefits of Thopaz⁺ after lung or cardiac surgery.

Features	Setting in patient pathway				
	Operating theatre	**Transport**	**ICU**	**Transport**	**Ward**
Thopaz⁺ Benefits	• No need to prime system • Does not need to be placed on floor • Immediate application of therapy allows for monitoring and managing of patient situation in regulated manner • No other equipment needed to apply suction • Easy handling during transport	• Ongoing drainage • Placement anywhere	• Regulated suction, easy patient monitoring (of air leak or in case of notifications) • Efficient uninterrupted drainage • Comprehensive fluid monitoring • Objective recognition of air leaks • Ease of use • Data collection of drainage parameters • Objective assessment of cessation criteria (air leak, fluid) allows for early diagnosis and facilitated decision-making	• Ongoing drainage • Placement anywhere	• Regulated suction, easy patient monitoring (of air leak or in case of notifications) • Efficient uninterrupted drainage • Comprehensive fluid balancing • Objective recognition of air leaks • Ease of use • Data collection of drainage parameters • Self-regulation of system (monitoring, notifications, mobility) increases staff convenience and reduces human error

Staff experience

Ease of use and improved staff confidence

The precision of measurement of fluid and air leaks with Thopaz+ and the reliability of digital measurements give clinicians confidence, because observations are accurate and less subjective than with underwater seal drains.

As Thopaz+ continually monitors and records measurements, which can be displayed as graphs, HCPs can observe time trends, which can improve decision-making and continuity of care.

> *"Thopaz+ offers staff the ability to see leaks, see trends, [and] provides continuity of care."*

Because Thopaz+ displays air and fluid measurements on its graphic user interface, it is easier to read and track fluid output. For example, staff do not have to make marks on the containers to monitor output or make estimations if underwater seal drains are knocked over and fluid displaces.

> *"Ease of use and ability to read things easily, change things easily, changing settings and programmes, and confidence in the device."*

Applying thoracic suction with underwater seal drains using a vacuum regulator to apply wall suction is complicated and associated with numerous pitfalls. In some departments, staff would need to locate equipment that was rarely used and seek support from a trained HCP. Because Thopaz+ provides and regulates its own suction, applying suction is less complex and faster, potentially reducing the time involved by 45 minutes for each drain fitted. Staff also do not have to check that the suction chest drain remains attached to wall suction. This in contrast to underwater seal drains, where staff may have to regularly assess the device to make sure the device is working properly as there are no audible signals to tell staff otherwise.

Documentation is generally the same as for underwater seal drains. However, Thopaz+ offers operational efficiencies that can free up nursing time – for example, the canister can easily be removed and replaced, and manual monitoring is reduced due to continuous recording of measurements with Thopaz+. The visual and audible notification system alerts HCPs of issues when they are attending to other patients, particularly when patients with drains are in single rooms, and the troubleshooting guide on the Thopaz+ display is useful and reassuring for staff.

EASE OF USE AND IMPROVED STAFF CONFIDENCE

STAFF COMFORT AND CONVENIENCE

TRAINING AND SUPPORT

Staff comfort and convenience

Whereas staff have to bend or kneel down to make observations on underwater seal drains positioned on the floor, Thopaz+ does not have to be placed below chest level and displays measurements on its graphic interface. Staff therefore do not have to bend down to check levels, which is particularly problematic in smaller rooms and can result in workplace injuries such as back injuries. Staff also do not have to check that Thopaz+ remains in the correct position or educate and remind patients, their families and other staff, such as transport and cleaning teams, to keep it below chest level.

Patients leaving wards with underwater seal drains for imaging require an HCP escort; however, Thopaz+ allows them to be moved around by porters without additional support from a nurse or healthcare assistant. If patients go to the bathroom or move around, they do not have to call a nurse to disconnect the drain from wall suction and reconnect it when they return.

> *"Once processes for using Thopaz+ are in place, it improves speed, dexterity, and workflow"*

> *"Medical teams therefore have more time to focus on other aspects of ward rounds, and nursing teams have more time to spend with patients."*

Training and support

As with any chest drainage system, staff must be trained. When using Thopaz+, this includes an understanding of the technology and how to set up the device, change canisters, and respond to audible signals. Clinicians also need to use the system regularly to maintain competence or refresh their knowledge with training materials.

In addition to training provided by a Medela representative, materials that support training on Thopaz+, with a particular focus on safety, are available on Medela's website, the Chest Drainage University, and Medela's YouTube channel. Staff experienced with the system train new users, which usually takes 30–90 minutes, and provide ongoing support if issues develop while the device is embedded into practice for the broader team. Departments should ensure that pathways for initial and ongoing training are in place, and some have included Thopaz+ as part of their foundation courses and induction procedures.

> *"The training materials are really useful. That's really helped me to implement them, because I give doctors and nurses the app, so people have got something to identify with and there's a great troubleshooting guide on there as well."*

> *"Initially [Thopaz+] appears complex...but applying thoracic suction through the old-fashioned system was very complex...with a little bit of practice it's actually very straightforward."*

A Thopaz+ simulator app developed by Medela also supports use of Thopaz+ in practice. The app is particularly useful when devices are used less frequently and allows those with less experience to manage the device without needing support from a more experienced member of the team. The online in-service course provides providing step-by-step instructions on set up and operational procedures, such as changing the settings at the bedside and switching canisters.

Although additional time is needed to train staff on Thopaz+ because it is a new system, this is outweighed by the benefits for the team compared with underwater seal drains. Because Thopaz+ is associated with fewer risks than underwater seal drains – i.e. issues with suction, device placement and the process for monitoring – training to achieve competence with Thopaz+ is actually less time consuming than training new staff to use an underwater seal drain.

Consideration

As with any new system, Thopaz+ may initially seem complex for new users. HCPs need to be trained with the correct competencies to use Thopaz+ and use the device regularly enough to maintain competency in clinical practice. In settings where Thopaz+ is not used currently, this is typically due to high staff turnover or because chest drains are not required often enough for staff to maintain competency. Medela has a vast library of educational resources available to support HCPs.

Patient experience

Patient experience

Most patients will not have experienced underwater seal drains and so cannot compare the experience; however, levels of patient satisfaction with Thopaz+ are high.

The main benefit of Thopaz+ for patients is ambulation, as they are encouraged to walk and mobilise after surgery. However, patients are immobilised when fitted with an underwater seal drain with wall suction and may be discouraged from mobilising if they have to call a nurse each time they get up and return to bed because of the wall suction. The portability of Thopaz+ and the fact it does not need to be positioned below the chest level means there is no planning or organising for the patient to get out of bed to move to the bathroom, outside the ward for rehabilitation and imaging, and even to the hospital shop or café without nursing support. Thopaz+ therefore empowers patients to freely move around whenever they want, while ensuring effective therapy is taking place.

> *"Quite a lot of people [in trauma] aren't really aware of what is happening to them, but some definitely want to be mobile and they appreciate the value of the system in making them so."*

Thopaz+ can facilitate earlier discharge, which benefits patients by reducing their time in hospital.

Some patients like to see their own progress by observing the reducing volumes of fluid and air leaks on the display.

> *"For patient experience, it's much better because it allows ambulation. It's easy to use, they can pick it up, you don't have to look after it like a chest drain bottle – it doesn't need to be below the hip so it can go at any level...I think that's the main key benefit."*

Summary and recommendations

Summary

The experience of HCPs within Oxford University Hospitals NHS Foundation Trust over the past 12 years has shown that Thopaz⁺ has multiple benefits (Box 1) in the right circumstances and should be available for the vast majority of patients requiring a chest drain.

Use of Thopaz⁺ involves a learning curve due to the transition from the perceived simplicity of underwater seal drains to a modern device. Once HCPs have received training and are competent in use of Thopaz⁺, the experience is universally positive, with increased confidence due to the device's reliability and its objective and easy-to read graphic display, as well as improved decision-making, operational efficiencies, reduced drain duration and length of stay, continuity of care, and improved staff and patient experience and satisfaction.

> *"Thopaz⁺ is easy to set up, easy to train and easy to use."*

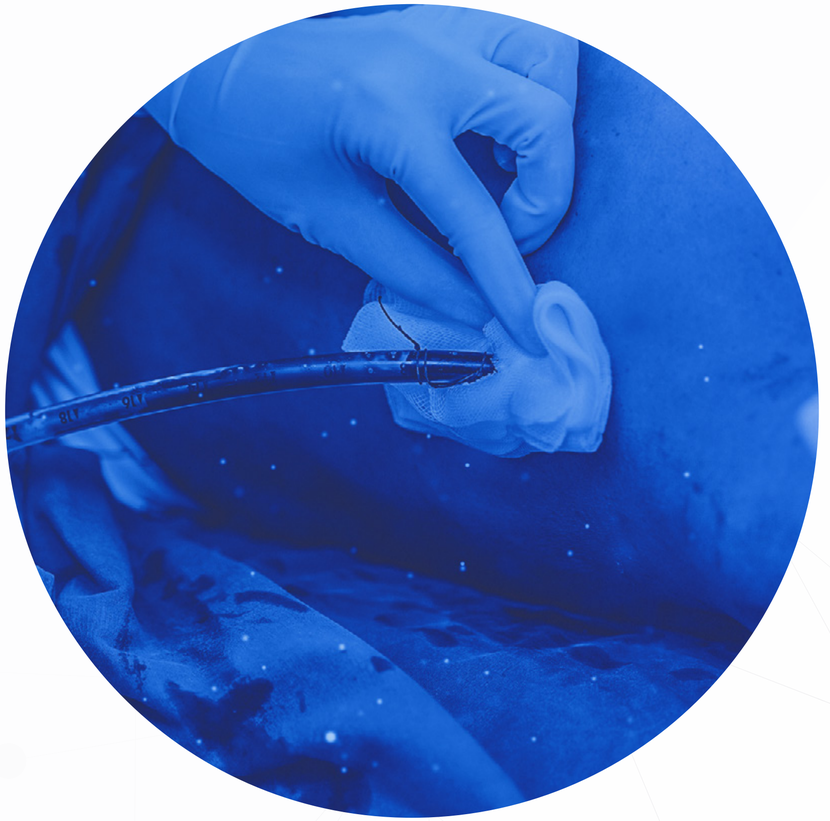
> *"Once you get to know the system, I would miss it. The drain is telling you what's happening with the patient and makes it, I think, so much safer to make clinical decisions."*

Box 1: Benefits of Thopaz⁺ in clinical practice

- Ease of use and device handling
- Effective chest drainage
- Reliability of function, particularly suction
- Objective measurements
- Validation of patient status
- Improved decision-making
- Operational efficiency
- Earlier mobility
- Shorter length of stay
- Faster bed turnover
- Patient safety and reduced complications
- Staff confidence
- Staff satisfaction
- Patient comfort and satisfaction

Recommendations

- Thopaz+ should be available for the vast majority of patients requiring a chest drain.
- All staff involved in placement and monitoring of drains should undergo training on Thopaz+ using Medela's educational resources.
  - Regular refresher training should be provided.
  - Thopaz+ 'champions' who can provide guidance and advice as required should be identified.
  - Staff should be aware of the support materials and Thopaz+ simulator app provided by Medela.
- Protocols should be in place to specify when Thopaz+ should or should not be used and if active suction is required. These should include:
  - information on setting up and switching between underwater seal drains and digital devices
  - practical differences between underwater seal drains and digital devices, such as location of the drainage unit
  - the significance of measurements and alerts provided by Thopaz+
  - how to overcome any issues that arise.



> *"Used correctly, this is **transformational technology.**"*

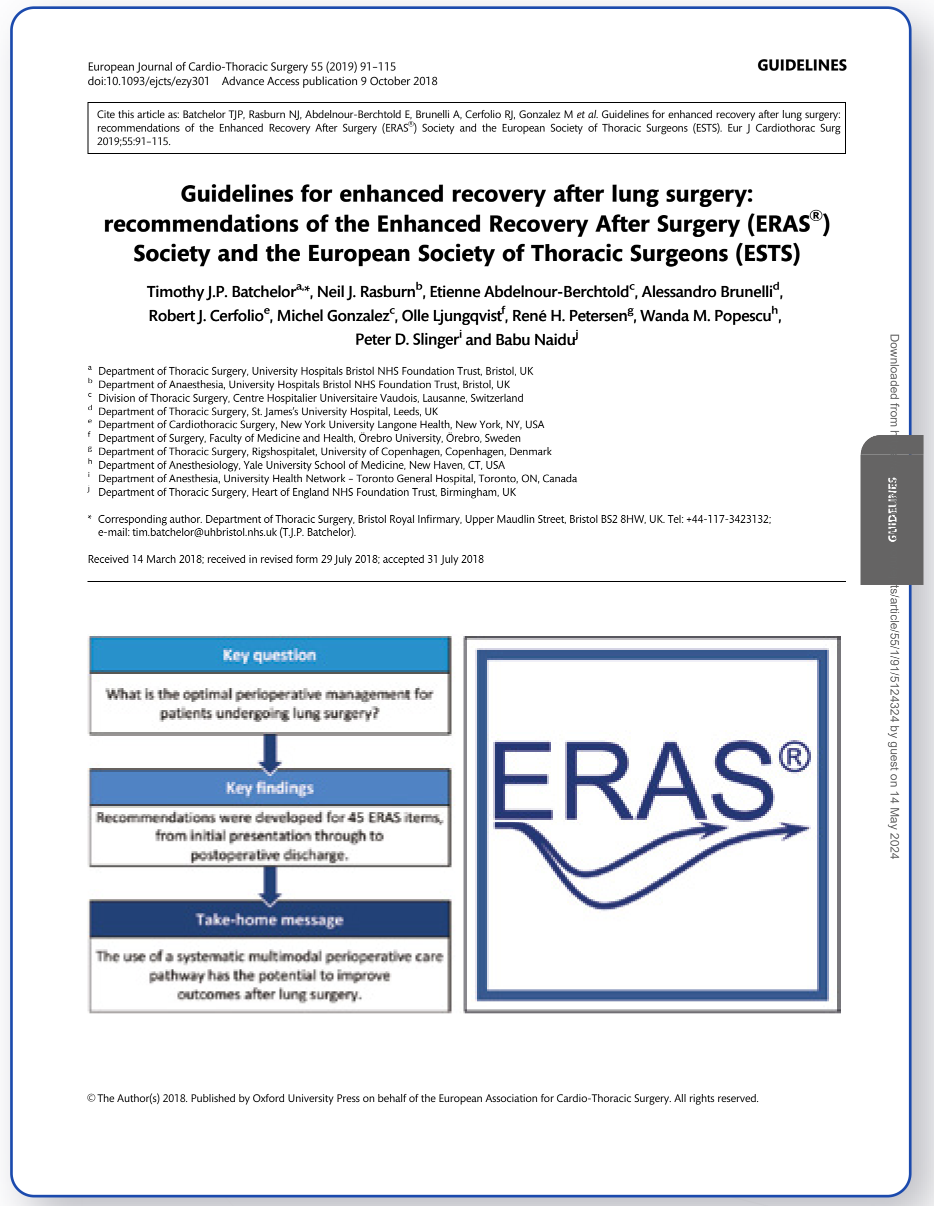
Appendices

Appendix 1: Chest drain guidance: ERAS®

Enhanced Recovery after Surgery (ERAS)

ERAS is an initiative to develop perioperative care and improve recovery through research, education, audit and implementation of evidence-based practice.[8] The ERAS® Study Group was assembled in 2001 to develop ideas based on the concept of multi-modal surgical care first raised in the 1990s.[8] The group discovered different units had a variety of traditions and actual practice differed greatly from what was already known to be best practice based on the literature.[8] The ERAS Study Group was registered as the ERAS® Society in 2010[6] and publishes guidelines for different specialties.

ERAS is well established in specialties and is achieved through the introduction of multiple evidence-based perioperative measures that aim to diminish postoperative organ dysfunction while facilitating recovering.[8] Proactive chest tube management is an integral and important part of ERAS pathways and crucial to optimising outcomes, influencing the speed of recovery and hospital LoS.[7]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GUIDELINES

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Guidelines for enhanced recovery after lung surgery: recommendations of the Enhanced Recovery After Surgery (ERAS®) Society and the European Society of Thoracic Surgeons (ESTS)

Timothy J.P. Batchelor[a,*], Neil J. Rasburn[b], Etienne Abdelnour-Berchtold[c], Alessandro Brunelli[d], Robert J. Cerfolio[e], Michel Gonzalez[c], Olle Ljungqvist[f], René H. Petersen[g], Wanda M. Popescu[h], Peter D. Slinger[i] and Babu Naidu[j]

[a] Department of Thoracic Surgery, University Hospitals Bristol NHS Foundation Trust, Bristol, UK
[b] Department of Anaesthesia, University Hospitals Bristol NHS Foundation Trust, Bristol, UK
[c] Division of Thoracic Surgery, Centre Hospitalier Universitaire Vaudois, Lausanne, Switzerland
[d] Department of Thoracic Surgery, St. James's University Hospital, Leeds, UK
[e] Department of Cardiothoracic Surgery, New York University Langone Health, New York, NY, USA
[f] Department of Surgery, Faculty of Medicine and Health, Örebro University, Örebro, Sweden
[g] Department of Thoracic Surgery, Rigshospitalet, University of Copenhagen, Copenhagen, Denmark
[h] Department of Anesthesiology, Yale University School of Medicine, New Haven, CT, USA
[i] Department of Anesthesia, University Health Network – Toronto General Hospital, Toronto, ON, Canada
[j] Department of Thoracic Surgery, Heart of England NHS Foundation Trust, Birmingham, UK

* Corresponding author. Department of Thoracic Surgery, Bristol Royal Infirmary, Upper Maudlin Street, Bristol BS2 8HW, UK. Tel: +44-117-3423132; e-mail: tim.batchelor@uhbristol.nhs.uk (T.J.P. Batchelor).

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The latest consensus guidance on ERAS after lung surgery, published in 2019, recommends use of digital drainage systems for optimal perioperative management of patients undergoing thoracic surgery – principally lung resection – as they apply regulated suction to maintain the preset intrapleural pressure, allow more informed decision-making about chest tube removal and reduce interobserver and clinical practice variability.[7]

Appendix 1: Chest drain guidance: NICE[1]

National Institute for Health and Care Excellence (NICE)

In 2018, NICE published medical technology guidance 37 on Thopaz+.[1] Its recommendations were based on the findings of an external assessment centre report included 13 studies (n=1,632).[9,10] A report on the experience with Thopaz/Thopaz+ at Oxford University Hospital NHS Foundation Trust[4] also contributed to Medical Technology Appraisal 37.


NICE National Institute for Health and Care Excellence

Thopaz+ portable system for manag drains

Medical technologies guidance
Published: 21 March 2018
Last updated: 6 June 2022

www.nice.org.uk/guidance/mtg37

Thopaz+ Portable Digital System for Managing Chest Drains: A NICE Medical Technology Guidance

Title: The Thopaz+ portable digital system for the management of chest drains

NICE recommends that Thopaz+ should be considered for people who need chest drainage after pulmonary resection or because of a pneumothorax.[1]

- The case for adopting Thopaz+ for managing chest drains is supported by the evidence. Thopaz+ can reduce drainage time and length of stay in hospital and improves safety for people with chest drains.[1] Its use may also improve clinical decision-making through continuous, objective monitoring of air leaks and fluid loss.
- Thopaz+ should be considered for people who need chest drainage after pulmonary resection or because of a pneumothorax.[1] The system can increase patient mobility because it is portable. Staff find it more convenient and easier to use than conventional chest drains.
- Cost modelling indicates that Thopaz+ is cost saving compared with conventional chest drains in people after pulmonary resection.[1] The estimated saving is £111 per patient per hospital stay, with savings mainly achieved through reduced length of stay. The NICE resource impact assessment shows that, at a national level, adopting Thopaz+ is expected to save around £8.5 million per year in England.

Appendix 2: Thopaz+ digital system (1)

Thopaz+ is a compact and portable digital chest drainage and monitoring system for aspiration and removal of surgical fluids, tissues, gases, bodily fluids or infectious materials from patients in appropriate care settings. It is indicated for all situations where chest drains are applied, particularly for thoracic drainage in the pleura and mediastinum in situations such as:

- pneumothorax
- cardiac or thoracic surgery
- thorax injury
- pleural effusion
- pleural empyema
- other related conditions.

The original Thopaz device was launched in 2007 as the first digital chest drainage system comprising a portable suction unit with a drainage canister and mains charger, which allowed patients to be mobilised with the patient.[11] In 2014, the original Thopaz device was upgraded to provide continuous measurement and recording of fluid quantities in addition to the existing air leak data to assess chest drainage management.

Thopaz+ provides regulated suction close to the patient's chest and continuously monitors and records air leak and fluid drainage.

THOPAZ+ SIMULATOR available for iOS and Android

GET IT ON Google Play

Download on the App Store

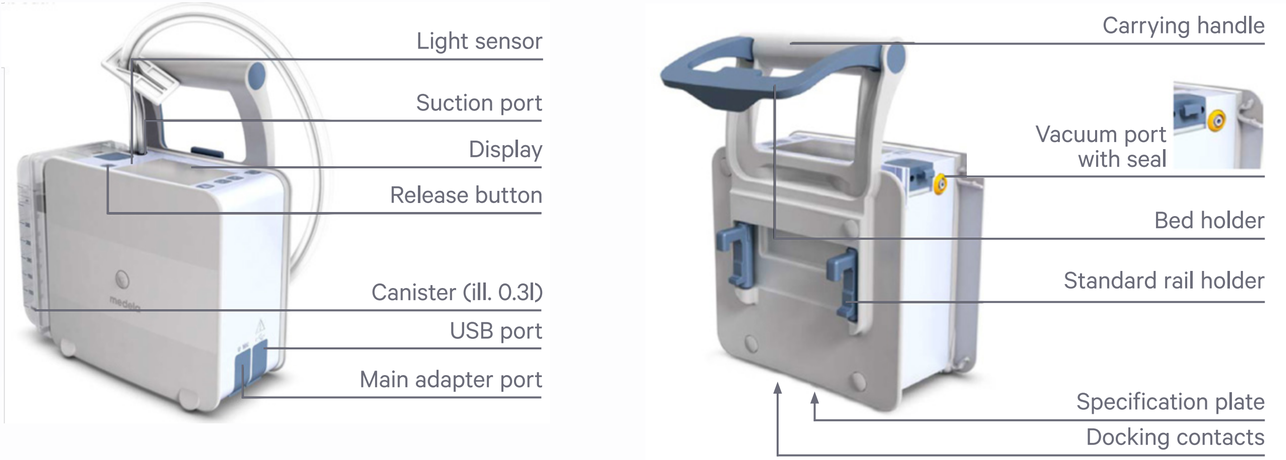
Appendix 2: Thopaz+ digital system (2)

Thopaz+ comprises an inbuilt, regulated suction pump with a digital display, rechargeable battery, tubing that connects to standard chest drain catheters and a Thopaz+ disposable fluid collection canister (Figure 1). Integrated sensors and intelligent software allow Thopaz+ to provide automated management of prescribed therapy, turning the pump on and off to ensure that only the vacuum required to maintain the negative pressure prescribed and set by the managing physician is applied – this is called 'regulated pressure/suction'. The system also digitally tracks fluid output rates and air leak trends over time. It is a dry system, with no fluids necessary for operation.

The lightweight battery-powered design allows for early and safe mobilisation, even for patients on active suction. Thopaz+ operates quietly and has a light sensor to regulate screen brightness, enabling adjustment to the surrounding light conditions and avoiding night-time disturbance. Thopaz+ has an electronic measuring and monitoring system with optical and acoustic status indications.

A digital colour display provides objective data in real time and in historical graphs, which allows easy tracking of the progress of therapy. When therapy is complete, the data can be transferred to a computer through a USB cable. On-screen notifications support on-site troubleshooting.

Figure 1. Key features of Thopaz+.

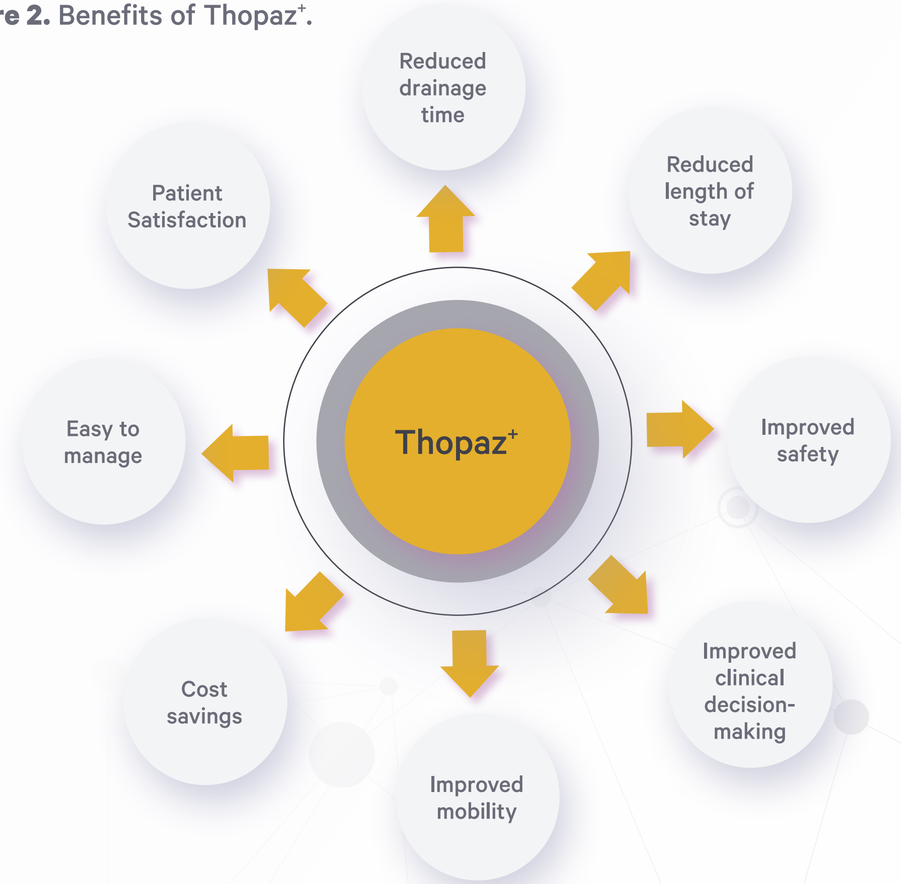


Appendix 2: Thopaz+ digital system (3)

Compared with underwater seal drains, evidence shows that Thopaz+ is associated with (Figure 2):

- improved clinical decision-making through continuous objective monitoring of air leaks and fluid loss[1,5–7,11–14]
- increased patient safety[1,11,15–17]
- reduced duration of drainage[1,2,15,18–25]
- reduced length of hospital stay[1,3,15,18–22,25]
- higher staff satisfaction[1,11,12,26]
- greater patient satisfaction[1,11,18]
- reduced costs[5,19,21]
- short learning curve and easy to use.[11,12,19]

Figure 2. Benefits of Thopaz+.



Appendix 3: Abbreviations

CCU critical care unit
ERAS Enhanced Recovery after Surgery
HCP healthcare professional
ICU intensive care unit
LoS length of stay
MRI magnetic resonance imaging
NICE National Institute for Health and Care Excellence

APPENDIX 1: CHEST DRAIN GUIDANCE
APPENDIX 2: THOPAZ+ DIGITAL SYSTEM
APPENDIX 3: ABBREVIATIONS
APPENDIX 4: REFERENCES
APPENDIX 5: ACKNOWLEDGEMENTS

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Report writer

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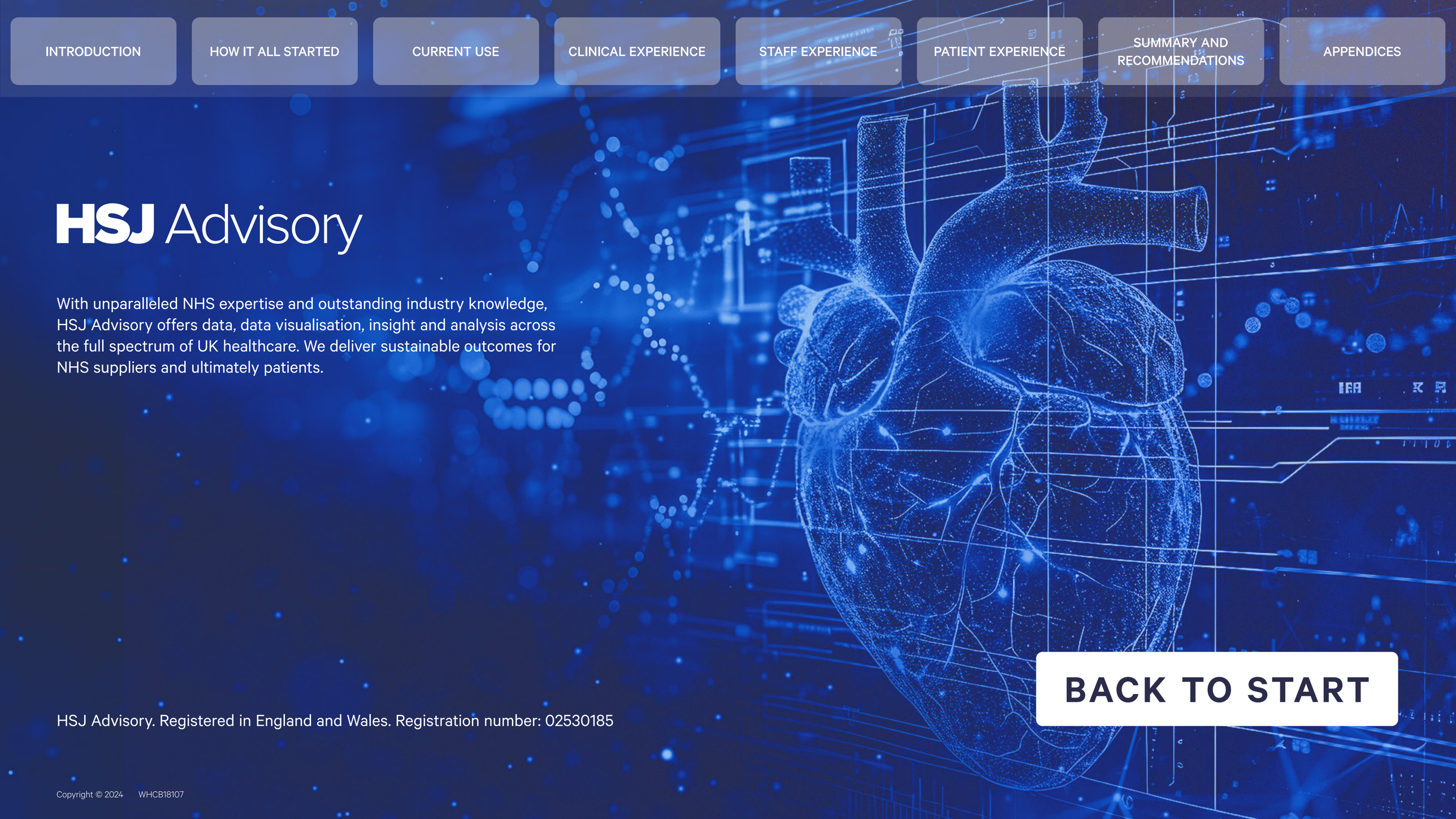

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