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ROYAL PAPWORTH

The new heart of
connected monitoring

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When Royal Papworth Hospital opened a new, state-of-the-art hospital, it required a flexible patient monitoring solution capable of ensuring the highest levels of patient safety. Working collaboratively with Mindray, the prestigious hospital developed a bespoke, connected solution that ensures seamless monitoring throughout the entire patient journey.

Royal Papworth Hospital is the UK's leading heart and lung hospital, treating more than 100,000 patients each year from across the UK. Since carrying out the UK's first successful heart transplant in 1979, the hospital has established an international reputation for excellence in research and innovation. The hospital performs more heart and lung transplants than any other UK centre, which also makes it one of the leading cardiothoracic transplant centres in the world.

As part of a project to modernise the hospital facilities, a new state-of-the-art building has been built – relocating services from the Papworth Everard site, to the Cambridge Biomedical Campus, adjacent to Addenbrooke's Hospital. Designed by clinicians with patients in mind, the new hospital building has been modelled on the shape of a human heart – providing optimum patient flow.

The new facility includes:

- Five operating theatres
- Five catheter laboratories
- Two hybrid theatres
- A 46-bed critical care unit
- More than 250 single patient rooms

As most patients will have their own single, ensuite rooms, there will be significant benefits in terms of patient privacy, dignity and infection control. However, monitoring patients in this single room environment requires careful consideration. The hospital needed a state-of-the-art monitoring solution to provide the highest levels of visibility and clinical insight, to ensure patient safety throughout the patient's journey.

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The solution

Following a robust procurement process, Royal Papworth Hospital installed 400 Mindray BeneVision N Series patient monitors – ranging from the N12 in patient rooms, to the N19 model, with its extra-large touchscreen, in ICU and theatres. A key benefit for Royal Papworth is the compact N1 monitor – a versatile bedside monitor, a multi-parameter module and a powerful transport monitor – all in one.

The monitoring solution also includes 18 workstations, five central stations, three eGateways connected to Lorenzo (the

hospital's electronic patient record [EPR] system), and 12 slave screens for the theatre department. The monitors are further integrated into an AV system in the theatres, so that the surgeons, perfusionists and anaesthetists can all visualise the information they require at a glance to support high quality care.

Transferring patients

A significant benefit of the Mindray system is the ability for the monitor to follow the patient throughout their care journey. When the patient is moved to another area within

the hospital, the Mindray module simply unplugs from the side of the monitor and can be used as a transport monitor. It can then be ‘plugged’ into the host monitor at the bedside, at the new location. There are no cumbersome leads to disconnect and reconnect, or clean between patients, and the patient is continuously monitored – ensuring seamless data and patient safety at all times.

Head of nursing, Cheryl Riotto, commented: “From a nursing perspective, transporting patients is no longer a headache and there is no interruption in the patient data. This helps to reduce anxiety for the nursing staff – having robust patient monitoring is the backbone of safe patient transfer. This, along with NEWS2, will make a big difference to the nursing team.”

This functionality will also deliver efficiencies for Royal Papworth, as Gorman explains: “On average, we transfer 11 patients per day from the ICU back to the ward and each of these transfers takes a minimum of half an hour. If you can achieve small time savings for each of these transfers, by not having to connect and reconnect the monitoring, these efficiency savings can quickly add up. The flow of patient data directly from the monitor and into the EPR, also means there is no need for manual input into another system, and there is no need to bleep the outreach sister when you have a deteriorating patient – the whole process is automated.”

NEWS2: meeting national standards with Mindray

The ability to automate the calculation of NEWS2 using the new monitors is a key advantage from the Trust’s perspective. NEWS2, the latest version of the National Early Warning Score (NEWS), is a new national requirement for the NHS. Supported by the Royal College of Physicians, the protocol aims to save lives by standardising the assessment and response to patient deterioration. While many hospitals calculate this early warning score on paper, Royal Papworth has been able to automate the process, using the BeneVision monitors – helping to eliminate human errors and speed up detection of patient deterioration.

“Mindray has taken the installation to the next level, by programming NEWS2 into the monitoring equipment and transmitting observations directly into our Electronic Patient Records via the eGateway – this is a huge advantage,” said Royal Papworth’s chief nursing information officer and EPR manager, Eamonn Gorman.

However, NEWS2 was originally developed to detect deterioration in the general patient population and, as a specialist heart and lung hospital, Royal Papworth’s cohort of patients have a very different physiology. Mindray was able to refine the NEWS2 display, without altering the score, to enable Royal Papworth’s clinical teams to add and view additional parameters that are important to the hospital, including:



Eamonn Gorman, Royal Papworth’s chief nursing information officer and EPR manager

- Emesis (sickness)
- Pain score
- Inspired oxygen

Mindray has also enabled integration with a third-party’s mobile alarming system, so that a team of senior clinical staff can be alerted and respond in the event of patient deterioration, providing a ‘safety net’ for nurses caring for patients in the single, ensuite rooms. In the event that a patient’s early warning score crosses a NEWS2 threshold, an alert is triggered via the mobile phone devices carried by the hospital’s equivalent of a clinical outreach team.

Further efficiency savings

The ability to perform 12-lead ECGs with the Mindray monitoring system has also created efficiencies for Royal Papworth. Previously this process would involve finding an ECG cart, printing the ECG onto paper, taking it to a doctor to get it signed, scanning it, then putting it into a file. With the Mindray monitor, caregivers can perform a 12-lead ECG at the bedside and automatically send it to a file share.

“This frees up nursing time and makes the process much more efficient,” Gorman added. “The results can be viewed and saved without leaving the bedside, creating a huge time saving for clinical staff and making the process much safer.”

Reducing errors

Gorman noted that the monitoring system is also improving the quality of data being captured. Previous audits have shown that calculating early warning scores on paper results in a high degree of error – the majority of charts will show inaccuracies when undertaken manually, according to Gorman’s own findings. The hospital can now be confident in the accuracy of the observations, but the automated system also helps guide the caregivers to make correct decisions in the event of an escalation.

“Each time you perform a set of ▶



observations, the screen outlines whether any escalation is required, based on the early warning score, and prompts are fed back to the caregiver advising them on what actions need to be taken,” Gorman explained.

“This is helping to reinforce the learning around NEWS2, already undertaken through our workshops. In addition, as the technology has the ‘feel’ of an Apple device, it is intuitive and simple to set up. When you are moving into a new hospital, using lots of new technologies, it is reassuring to know that the one bedrock of patient safety – the monitoring system – is really easy to use.”

Monitoring during complex surgery

Mindray’s solutions have also been installed in the most critical areas of the hospital, including the theatres – where the complexity of surgery demands the highest levels of patient monitoring. The solution provided includes the iView function – a modular PC that integrates with the monitor, allowing connection to any hospital informatics system – such as PACS and pathology results. This patient data can then be displayed on the Mindray monitor for easy viewing and visibility.

A vital aspect of the project at Royal Papworth has involved tailoring the visual presentation of vital information to support complex cardio thoracic surgery. Royal Papworth undertakes some of the most challenging and innovative procedures in the UK, so the need to quickly gain an

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Eamonn Gorman, chief nursing officer and EPR manager, Royal Papworth Hospital NHS Foundation Trust

understanding of the patient’s status with clear monitoring data is vital – there can be no ambiguity in terms of graphical presentation.

“We have worked to develop a slick and sensible configuration, and the support we received was exemplary,” commented consultant anaesthetist, Dr Florian Falter.

He explained that the ‘impressive’ resolution of the screen is extremely valuable in theatres – particularly when the team is working on a challenging case: “If you have a complex case with lots of arterial lines, the colour options can help avoid confusion when it comes to visualisation. The clarity of the monitor helps your grasp of the situation. This is particularly important when there is a need

to act fast and the team is under pressure.

“The monitor is more than just a device that produces colourful graphics, however. Cardiac monitoring is very complex, and we have to deal with many different facets at the same time – whether it is coagulation, the patient, the heart, the bypass machine, or the surgeon. My vision is for a monitor that becomes an information hub; whereby, at the touch of a button, you can change what you see on the screen.”

Connectivity and interoperability

Interoperability between Royal Papworth’s new monitoring and its hospital information systems is allowing clinicians to use patient data more intelligently, to inform clinical decisions, enhance clinical efficiency and improve patient outcomes. These integrations include:

- Lorenzo – main electronic patient record system
- Metavision – clinical information system for ICU
- M-ighty – e-observations, NEWS2 and alerting system
- 12-lead ECG PDF to Lorenzo
- Serial output to Liva Nova heart-lung perfusion system
- GE Aisys CS2 anaesthetic machine with waveforms.

The flexibility of the solution is made possible by the BeneLink Interfacing Module. By becoming a ‘data hub’, BeneLink has





streamlined equipment in theatre, integrating multiple third-party devices into a single display. This allows simultaneous viewing of a variety of parameters for rapid insight into the patient's status. Cardiac output and a variety of other critical data can be displayed on the monitor screen, helping to inform clinical decisions, enhance clinical efficiency and ultimately improve patient outcomes. This helps the hospital to optimise patient management according to their cardiac stability.

The R&D team at Mindray was also able to turn around bespoke connectivity solutions to Royal Papworth at record speed. In less than a week, the company developed software to enable the monitor to collect all of the data from their anaesthetic machine, along with the ability to display the CO₂ waveform. Mindray has also been working closely with LivaNova, a manufacturer of cardiovascular and neuromodulation solutions, to provide the ability to connect the company's bypass machine with the BeneLink module.

"When indicated, it is valuable to have information, such as the flow of the bypass machines, so that everyone knows what the SVO₂ is on bypass and the current flow," comments Dr Falter. "Space is always at a premium, so being able to visualise all of this information via the one monitor will make it easier to keep an eye on what is going on in theatre. Having this flexibility will not only improve patient safety but make my life easier," commented Dr Falter.

New site goes live

The first patients were admitted to the new hospital facility on 1 May 2019 and, after 101 years of saving lives and transforming medicine, the Papworth Everard site officially closed on 4th May. Four operations took place at the new site on the first day of activity (1 May) – two thoracic cases and two cardiac cases –

as well as eight procedures in the cath labs.

During the move from the old site to the new hospital, a total of six clinical application specialists (CAS) from Mindray were on-site for two weeks, to support the transition – ensuring the process was as smooth as possible.

"Providing this level of support is about going the extra mile and ensuring the clinical staff were put at ease at what was potentially a stressful time. They were not just having to deal with new monitors but change on a huge scale," said Mindray's clinical application specialist, Emily Best.

Looking to the future

Close collaboration with clinical partners at Royal Papworth will ensure the technology remains cutting-edge and evolves with the changing demands of the hospital for years to come. Responsible for driving the installation from a clinical engineering perspective, Royal Papworth's electro-medical services manager, Paul Robbins, explained the importance of partnering with a supplier that can ensure their technology remains "state-of-the-art".

"Royal Papworth provides cutting-edge innovation in its field and we wanted to use technology that reflected this, with the ability to move and evolve as we move and evolve. Mindray's solution offered the greatest scope to achieve this," Robbins said.

The hospital is currently using around 50% of the BeneVision's potential functionality, but there is scope to significantly expand on this, in the years to come, as the hospital scales-up utilisation of the system's full capabilities to meet its evolving demands.

Royal Papworth is now looking at the next possible steps in terms of functionality – from neuro observations, such as the Glasgow Coma Scale (a measure of consciousness and responsiveness in patients), to epidural

observations and PCO₂ recording. There is also interest in the potential for telemetry – this function will enable continuous monitoring while the patient remains active, without the restriction of being attached to a bedside cardiac monitor.

"We are just at the start of our journey with Mindray," Robbins concluded. **CSJ**

Key Outcomes

- The hospital now has comprehensive patient monitoring, throughout the patient journey, reducing the gaps in data to ensure maximum patient visibility and safety.
- The flow of patient data directly from the monitor and into the EPR improves safety and releases time to care, through more efficient workflows and the reduction of manual transcription.
- Staff can now avoid patient misidentification at the point of care, with positive patient identification on-screen via ADT lookup.
- Staff and management are now confident in the accuracy of the observations and NEWS2 calculations, ultimately helping save lives.
- Enhanced patient safety through rapid identification of deterioration, the automated notification process is helping to speed up intervention by the outreach team.
- Integrated 12-lead ECGs has created time efficiencies and eliminated the need for standalone ECG devices, maximising the investment and streamlining equipment inventory.
- Streamlined equipment in theatre, integrating multiple third-party devices into a single display.

