



Cardiology goes paperless

Executive summary

ALB FILS KLINIKEN is a healthcare provider in the south-west of Germany. Situated between Stuttgart and Ulm, it serves the region from two locations; the 130-bed Helfensteinklinik in Geislingen, and the larger 645-bed Klinik am Eichert in Göppingen, which provides specialist care. Together, the two hospitals employ around 2,400 staff, and treat in the region of 35,000 inpatients a year.

ALB FILS KLINIKEN had a vision of operating as a paperless facility and being the first 'green' hospital in Baden-Württemberg, a goal that required thorough preparation ahead of time. For cardiology, this started with the procurement of MAC™ 2000 12-lead ECG devices to replace older equipment and standardize the systems in use, followed by implementation of the MUSE™ Cardiology Information System. Subsequently, the hospital expanded its fleet of ECG systems to include MAC VU360™ devices, to support the needs of some higher acuity areas. It also integrated its CARESCAPE™ patient monitors into MUSE. This enabled capture and storage of 12-lead ECGs directly from bedside monitors, further enhancing the hospital's connected workflow solutions. Patient records are now online and always available, and the data can be reviewed and reports compiled from any workstation, regardless of the patient's location. Processes have been standardized and optimized, and there is no longer a need to outsource management and archiving of paper records to a third party, saving time and reducing costs.

- **148 beds at Helfensteinklinik in Geislingen**
- **627 beds at Klinik am Eichert in Göppingen**
- **~2,400 staff across two sites**
- **~30,000 inpatients a year (all patients)**
- **~110,000 outpatients a year (all patients)**
- **~160,000 ECGs a year**
- **21 MAC 2000 12-lead ECG devices**
- **4 MAC VU360 12/15-lead ECG devices**
- **MUSE Cardiology Information System**
- **CARESCAPE monitoring**



Introduction

ALB FILS KLINIKEN has a vision of a greener future, and a key part of this is the transition to a paperless workflow. This would eliminate the need to transfer paper records between wards and departments, ensuring that patient records are readily available when required and streamlining the treatment pathway, as well as removing the need for a secure physical archive facility.

Digitalization cannot happen overnight. It requires a great deal of forethought and planning. Recognizing this, ALB FILS KLINIKEN decided to embark on its digitalization projects early on, well before the planned 'go live' date, to enable a smooth transition to a completely paperless facility. For cardiology services, this process started with the standardization of its ECG devices in 2016, followed by the implementation of the MUSE Cardiology Information System. Today, the department has successfully and cost-effectively transitioned to a paperless workflow.

“From an operational perspective, we save work time by not having to manage the paper. The management and archiving of paper reports has also been eliminated, so we no longer need to outsource this to a third party. This saving, and the saving in worktime, justifies the investment. We have also benefitted from optimization of our reporting, which should be taken into consideration.”

Dr. med. Ingo Hüttner, CEO, ALB FILS KLINIKEN

Key challenges

Standardized equipment

The digitalization of cardiology services started with the procurement of new 12-lead ECG devices to replace older systems that needed increasing levels of maintenance. ALB FILS KLINIKEN tested and evaluated a number of devices, looking for a system with the functionality to export patient data to the hospital information system (HIS), and that was WLAN ready.

Managing paper records

Managing paper records is time consuming and costly, requiring maintenance of a secure archive facility. Patient records have to be physically transported between different locations, and are not always to hand when required, which can result in avoidable repeat ECGs. Digitalization enables instant access to patient records and online reporting, improving the quality of care and saving time. It also eliminates the need for manual transport, storage and retrieval of paper documentation. A software solution was required that could provide long-term digital storage of ECG waveforms, integrate with the existing network via WLAN connectivity, and support reporting workflows.

Manual processing

The hospital's existing ECG devices plotted traces on paper, which then had to be interpreted manually by the clinician, using a ruler to take measurements. The measurement data and diagnosis were then dictated to an assistant for entry into the HIS. However, with manual data transfer there is always potential for transcription errors to occur.



Solutions

A single medical technology

The decision was made to upgrade and standardize the outdated, analog ECGs with new digital systems, and the hospital chose the 12-lead MAC 2000 device from GE Healthcare after an extensive evaluation process. The MAC 2000 is a cost-effective, WLAN-ready system with the functionality to export ECG data electronically, meeting not only the hospital's current needs, but also future digitalization demands. Subsequently, the hospital invested in a number of MAC VU360 devices, to support the needs of some higher acuity areas, further expanding its ECG capabilities.

A paperless data system

Once the ECG devices had been standardized, attention turned to establishing a paperless record system. The preferred approach was to work with existing partners, and this provided three options for digitalization: the HIS, the existing PACS, or GE software designed to work with the ECG instruments. Based on input from interested parties across the hospital – purchasing, medical technology, medical IT, and clinicians from a range of specialties – GE's MUSE was chosen as the best option for long-term storage and archiving of digital ECGs, and for reporting via a PC client. WLAN connectivity means that all ECG instruments connect to MUSE remotely, and the software also offers the possibility for future integration of additional diagnostic devices, such as ambulatory blood pressure, Holter ECG, stress testing ECG and pulmonary function devices. ALB FILS KLINIKEN has also integrated its CARESCAPE patient monitors into MUSE, enabling capture and storage of 12-lead ECGs directly from bedside monitors, further enhancing its connected workflow solutions.

Efficient data processing

Manual data processing is time consuming, with the ongoing risk of human errors. The implementation of a digital ECG workflow overcomes these issues. MUSE enables digital transfer of data, eliminating transcription errors, and provides immediate access to the patient's complete ECG history. Integrated measurement tools allow post-processing of the raw data – including measurement of PR, QRS, QT, RR and QTc intervals – to support the clinician's diagnosis. Reports can even be partially automated based on Marquette™ 12SL ECG analysis – a clinical decision support algorithm drawing on global scientific background – to help clinicians achieve more effective, higher quality diagnoses.

“Paper ECGs were not always available or were mislaid on the way to the wards. With digitization, they are always available, and modern analysis software makes it possible to view and report on the complete ECG from any workstation, independent of the patient's location. That is a big advantage.”

Prof. Dr. Stephen Schröder, Head of the Clinic for Cardiology and Internal Vascular Medicine

“We have a digital worklist for reporting and, therefore, a quality improvement.”

Dr. med. Ingo Hüttner, CEO, ALB FILS KLINIKEN





Outcomes

A streamlined workflow

The combination of the MAC 2000 and MAC VU360 devices, CARESCAPE monitoring and MUSE software delivers an efficient and effective ECG workflow. Each patient is issued with a barcoded wristband, which is scanned to confirm their identity prior to performing the ECG. Patient data is automatically retrieved from the HIS before the ECG is carried out – removing the possibility of manual input errors – and the raw data is digitally transmitted to MUSE for post-processing. Finally, the ECG data and diagnostic findings are transferred to the HIS in pdf format for online access.

A better medical process

MUSE analysis software allows clinicians to view and report complete ECG results from any workstation, independent of a patient's location. This has advantages not only from a documentation perspective – there are no longer stacks of paper in the cardiology department pending diagnosis – but also for the medical process itself, since data can be reviewed by several clinicians in parallel. For instance, an Emergency Department doctor can use an ECG for diagnosis, while a cardiologist elsewhere in the hospital concurrently reviews the data to provide an expert second opinion. This is particularly beneficial for training junior doctors. In the future, it will be possible to integrate additional functional diagnostic devices into MUSE for instant online access to measurements, graphics and results in the reporting system, increasing efficiency and decreasing manual errors.

Fewer repeat ECGs

Implementation of a digital workflow has led to a reduction in repeat ECGs. Electronic data transfer via MUSE eliminates transcription errors and provides immediate access to the patient's complete ECG history.

Going paperless drives down costs

Previously, all ECGs had to be printed and archived, at significant cost. The annual cost of paper alone was in the region of €9,000, plus the additional expense of retrospective digitization of data, and storing and archiving the hard copy. The time and cost of manual evaluation and diagnosis of ECGs was also considerable. Adopting a paperless strategy reduces the time spent managing paper documentation. It also reduces the costs associated with archive management, as there is no longer a need to send paper reports to a third party for storage.

Summary

Digitalization of the ECG workflow is a foundation stone in ALB FILS KLINIKEN's complete digitalization strategy, which aims to make the hospital as near paperless as possible. Cardiology has now achieved its goal of going paperless, improving the quality of its services by reducing the number of repeated and undiagnosed ECGs.

With MUSE, ECGs are always available online, saving time by avoiding in-house transfer of documentation and paper storage. An interpretative algorithm can help clinicians distinguish between healthy and pathological ECGs by providing an initial diagnosis. Combined with a systematic approach to data review, this has helped to standardize the evaluation and diagnosis of ECGs, as well as documentation and reporting.

Results can be reviewed concurrently by two or more clinicians in different locations, and the abolition of paper documentation has eliminated the need for retrospective digitization of ECG records. Additionally, there is provision to integrate further devices – such as ambulatory blood pressure, Holter ECG, stress testing ECG and pulmonary functional devices – into MUSE in the future. While the initial goal was to improve the medical diagnostic quality, digitalization of ECG services with MUSE has economic advantages too. The significant cost of ECG paper has been eliminated, as well as the cost of storage, maintenance and archiving of paper documentation.