MICROBIOLOGY IN RURAL GHANA

Pathology Operations Manager **Azra Khan** discusses the challenges of making a difference in the developing world.

The charity Foundation for Rural Education and Empowerment Development UK (FREEDUK) was started by Dr Dery Tuopar, after he returned from visiting a sick relative at Nandom Hospital in Ghana. The failing health standards and lack of resources saddened him very much and, together with his colleagues, he formed FREEDUK.

In 2005, FREEDUK formed a link with St Theresa's Hospital, a remote village hospital in the Upper West region of Ghana. I have been a core member and Trustee since 2007, when the first team of 22 professionals travelled to Nandom village. The team comprised surgeons, dentists, dental nurses, retired GPs, teachers, a football coach, carpenter, journalist, and myself – a biomedical scientist, aiming "to make a difference in the developing world through the use of our professional skills".

St Theresa's Hospital is the main healthcare provider for nearly 500,000 people, attracting patients from a radius of 200 miles. It was built in the classic colonnade structure and is surrounded by vast grounds, where the patients' relatives camp – washing, cooking, and sleeping in the shade of the trees, alongside their livelihood; the goats and sheep they bring with them. Those from afar set out before sunrise, either walking for miles or hitchhiking. Sadly, many are too weak or sick and die en-route to the hospital.

Pathology and microbiology

The pathology department comprise four laboratory rooms, with specimen reception at the front entrance, adjacent to the serology and blood taking room, and a patient waiting area. Around the corner three microbiology rooms are laid out in a similar manner, with stone laboratory benches against one wall.

On our first two visits, equipment was limited and only just in working order.

There were no facilities for extensive haematology or biochemistry blood tests, and samples were sent 100 miles away to Kumasi for testing. Hepatitis B, C and HIV investigations were analysed using commercial kits, stored in old fridges with no assurance of the correct storage conditions. Also, there was no guarantee the blood bank fridge for storing precious donated blood, was reliably achieving optimum temperature. More shockingly, I observed that mouth pipetting was normal practice.

What we in the western world would regard as single-use items, such as slides and syringes, are soaked in bleach overnight, washed and re-used. Cardboard sharp boxes and discard bins are overfilled with used blood tubes and needles. At the end of the day they are taken to an area on the hospital grounds for incineration.

The microbiology test repertoire was basic – gram-stains, urine dipsticks, ZN stains for TB, malaria films, faecal microscopy for ova, cysts and parasites comprise the main bacteriology investigations. However, without culture methods to support Gram-stain results and urine analysis, microscopy results are often inconclusive and of no diagnostic value for effective patient management and correct antibiotic therapy.

Resources and supplies

On this first trip in 2007, there was little time to help change practices or teach. The rooms were dusty and untidy, strewn with laboratory papers, leaflets and contained disused items, and resembled storage rooms, rather than diagnostic laboratories, so the time was used to clear out the laboratories and discard disused equipment, reagents and paperwork.

On subsequent trips, we have made small changes through teaching, conversing and exchanging ideas and experiences in all the pathology areas. This has been achieved by the enthusiasm and willingness of the staff to learn and take on the advice and involvement we are able to offer. They are knowledgeable, trained and experienced, and work to the standards their limited resources allow.

In 2010, we identified a small storeroom within one of the microbiology labs for conversion into a media preparation room. A year later, we were not sure what state it would be in, or whether we would have the equipment we needed. We were unsure if we would have permission to refurbish the room into a media preparation room, or if we would have the equipment to prepare culture media.

We took out with us small amounts of MacConkey and Iso-sensitest agar powder, 40 sterile petri dishes, one Schott bottle and a short panel of Gram-negative antibiotics and ESBL identification discs.

The room took almost a week to refurbish. Wood, paint and other materials were bought 18 miles away from Jirapa, which meant waiting for someone to drive out and purchase the items. Also, our carpenter was busy making shelving and restoring tables and chairs for the library project, and he had limited time.

Our Ghanaian colleagues located a small dental bench top autoclave, which was only able to take one 500ml Schott bottle at a time.

Single-use items, such as slides and syringes, are soaked in bleach overnight, washed and re-used

Testing times

We set about preparing our first batch of MacConkey agar. The autoclave was able to reach the 121°C temperature, but could not hold at that temperature for 15 minutes, as required. However, we poured out the media as aseptically as possible and hoped there would be no contamination. On settling and drying, the plates showed no obvious signs of contamination. As there was no way of quality controlling the plates, we could only hope they would be good.

We were brought three swabs for culture, taken from three different patients showing signs of post-operative infection. These were plated out onto the MacConkey agar plates. As we did not have an incubator, the plates were left on the bench overnight. The temperature in that room often far exceeds 37°C and drops only 1- 2°C in the night. The next morning all three had isolated a pure growth of a coliform bacteria. We had no means to identify the organisms, but as lactose forming coliform.

We prepared Iso-sensitest agar plates in the same way as the MacConkey agar and carried out sensitivity tests on each of these isolates. In our rural village hospital laboratory with limited resources we inoculated three to four colonies into 5mls of sterile water and visually checked

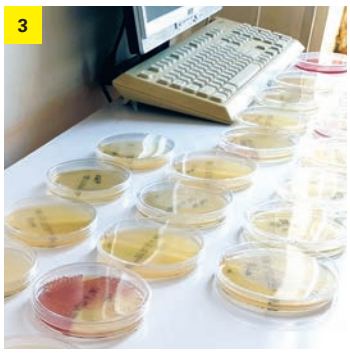

Fig. 1. Outpatients – early morning
Fig. 2. First microbiology cultures at St Theresa's Pathology Laboratory
Fig. 3. Overnight incubation of culture plates on bench

that the suspension was not too heavy. Then a sterile swab was immersed into the suspension, and used to manually spread the surface of the Iso-sensitest agar plate. Antibiotic discs were applied manually and once again left on the bench overnight to "incubate".

The following morning we identified one organism to be a multi-resistant strain (possibly a carbapenamase producer) and one to be an ESBL producer.

On our return in 2013, we were very fortunate that ThermoFisher Scientific (Oxoid) donated dried MacConkey media, full panel of Gram-negative and Gram-positive antibiotic discs, disc dispensers and other identification reagents. We still had not acquired an incubator and so would have to incubate plates on the bench. The media was prepared in the same way as before, but limited culture media and incubation conditions meant that we would miss Gram-positive organisms or the more fragile ones.

However, we felt pride when we successfully poured our culture plates in this make-shift preparation room with all the potentials for contamination and constant power cuts, and then actually inoculating, isolating and identifying relevant pathogens.

A total of 23 swabs were cultured and isolated mixed growth with:

- 19 Enterobacteriaceae – seven ESBL
- 4 Staphylococcus aureus – two MRSA, two MSSA
- 14 Pseudomonas – mainly colistin resistant
- 1 Haemolytic Streptococcus Group A.

Groundbreaking

Patients are routinely treated with a "cocktail" of antibiotics to cover all possible infections. Our results showed that patients were either on the wrong or unnecessary antibiotics. However, for the first time ever, for a short while during our time in Nandom, visiting doctors were able to review the antibiotic regimen and adjust therapy accordingly. This was a historical moment for the hospital and FREEDUK.

In 2016, I returned with an aim to continue training staff in carrying out culture and sensitivity, while processing wound swabs, as well as an idea to carry out a study on the prevalence of Carbapenemase carriage in the Nandom community. This time, BioMérieux kindly donated chromogenic media for ease of identification of Carbapenemase producing coliforms. Despite liaising with hospital staff requesting samples, instructions were not followed and only a small number of samples were collected. Twelve stool swabs from the healthy community and six from in-patients were forwarded to the laboratory. The results of this "snapshot" study showed: 15 isolates to be ESBL strains only; one isolate to be CPE strain only; three isolates demonstrated both ESBL and CPE activity. Although only a small study cohort, this demonstrates the potential for a larger study into the high carriage and misuse of antibiotics in this rural village community.

The impact

We have seen many changes in the laboratory services and repertoire of tests over the past decade, but it is difficult to make a large impact due to the short time we are there. But each time we visit we see developments and improvements in the hospital building and surroundings.

The hospital surroundings, the communities of Sub-Sarahan African countries, the poverty, a burdened healthcare system and sickness are all images that I have seen from the comfort of my home and privileged lifestyle, but with my involvement with FREEDUK I have come to witness the starkness and pain of the developing world. The people of Nandom are close to my heart and give my yearning to work in humanitarian projects a deeper passion. BMS

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