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PET/CT Moving into the Mainstream

Slow Adoption and Political Decisions Curb Growth

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With any technology that has sat on the shelf for a long time, a rise in sales is often viewed with some skepticism. Is this a false dawn, a blip only to be followed by a downturn? PET has taken a very long time to go from a promising research tool to everyday routine use. CT and MR were both well established ten years after the first commercial systems were launched. PET has taken over fifteen years to reach the same point on the curve. But now the future growth in system placement and patient examinations looks bright.

The development of PET over the past five years in a routine clinical setting has mirrored that of the earlier modalities, CT and MR: rapid establishment in Germany, Belgium, and Italy followed by the Netherlands, Switzerland and Spain, with Scandinavia and the UK very late in establishing a lower routine provision. However, the demands on the healthcare system in Germany have stalled development of PET and this has impacted growth in neighbouring German speaking countries.

In 2006 the number of patients receiving PET scans in Europe broke the 500,000 barrier, up 39% on 2005. In five years time, the number of studies are likely to approach two million.

PET/CT Still Costly Though Prices Falling

PET in its new guise of PET/CT is viewed as expensive, but is this fair? While a 64-slice system costs 2.3 million Euro, a more modest 6 or 8 slice unit costs 1.6 million Euro, marginally more expensive than a 1.5T MRI.

The cost of a radiology examination is heavily influenced by the cost of the equipment on which it is performed, and the throughput. Early PET cameras were relatively slow but PET/CT is much faster. Taking Europe as a whole, the average throughput is ~1,700 patients per year, but in systems placed in the past three years, average throughput is much higher.

We have identified a number of PET/CT system carrying out in excess of 2,500 examinations per year. At these throughputs, the price of a PET/CT scan is in the order of 250 Euro, plus the cost of radioisotope and reading fees.

New Offering on the Horizon

In the next five years it seems probable that throughput will rise as new technologies are introduced. The Gemini TF launched by Philips in 2006, is the first clinical machine that encompasses hybrid PET/CT combined with Time of Flight (TOF) technology. It is strongly rumoured that other suppliers will also announce TOF systems in the next twelve months.

TOF refers to the transit of photons from their source in the body to the PET scanner's scintillator ring. Measuring the slight difference in the arrival times of two photons from the same positron with sufficiently good timing resolution determines the distance the positron was from each detector. Measuring TOF and incorporating that information into PET imaging can halve the amount of noise in an image. An improvement in signal to noise allows trade-offs – one is reducing the time to acquire the image. According to Philips, for a whole-body PET scan, image acquisition is accomplished in less than ten minutes.

The price of PET/CT, which is currently heavily influenced by the CT component, will fall as lower specification multislice scanners become more affordable. By 2010 an annual throughput of 4,000 patients and PET/CT pricing of below 1.5million Euro is feasible.

Radioisotope Production a Pricey Component

Producing the radioisotope, which is almost exclusively 18FDG, is potentially an expensive process but benefits massively from economies of scale. Today in Europe, most sites estimate that 18FDG costs them between 300 - 400 Euro per patient. FDG is usually supplied 'in bulk' and then 'aliquoted' for each patient. In the United States, in localities where there are high volumes of PET scans and a large number of suppliers of 18FDG, pricing may be as low as 150 Dollar per patient. It is reasonable to assume that European pricing will weaken as more PET/CT units are installed.

Initially the model in Europe was to have a PET camera alongside a cyclotron. This was not surprising given the limited opportunities to source 18FDG. Over the last three years there has been a shift towards commercial supply. In 2006 we estimated that around 61% of 18FDG was supplied by commercial suppliers. Legislation, and in particular directives governing quality control and good manufacturing practice, has made it increasingly difficult for centres to supply their neighbours unless they have the necessary paperwork. Moreover, PET has moved out of larger institutions and into settings such as general hospitals and private practice which are more inclined to buy-in diagnostics. By 2006, universities comprised less than one-third of centres offering PET or PET/CT examinations.

Sites which already have a radiopharmacy are far more likely to investigate production in-house than those which are supplied from elsewhere. Supplies of 18FDG in Spain are almost entirely commercial whereas in Italy a high proportion of sites have a cyclotron on-site.

It is not clear whether in the future the drift to commercial supply will continue. As throughput rises onsite production becomes more attractive. Moreover suppliers have made it far simpler to synthesise tracers.

With the cost of a PET-CT scan and the cost of tracer adding up to less than 500 Euro it is quite easy to see that with reading and interpretation of the images a total procedure fee of 600 Euro is not unreasonable. In 2007, PET reimbursement (CMS) in the US was reduced by ~25% to below 950 Dollar, excluding professional charges.

Oncology to Continue as 'Bread and Butter' of PET/CT

It is easy to overlook the fact that PET was originally a neurological application. The majority of early studies followed brain activity in response to stimuli. In Europe neurology now accounts for only ~1% of patients. Ninety-seven percent of studies are oncology with the remainder cardiology and studies of inflammatory conditions.

In the next few years the growth of PET in Europe will be primarily driven by further expansion of oncology applications. A question that remains unanswered is whether PET will become one more modality in the work-up of oncology patients, or will something be replaced. Until recently the perceived cost of PET and PET/CT has deflected any argument that it may replace existing studies. Now with the cost of PET/CT falling there is more attention being paid to this subject.

Conclusion

PET was a nuclear medicine technique and PET/CT is nearly always located in the nuclear medicine department. But PET/CT is of considerable interest to radiologists. The prominence given to PET/CT at recent RSNA meetings only reinforces the point. PET/CT is a new modality and offers practices the opportunity to expand. The dynamic between CT and nuclear may also in the case of PET work in favour of CT. PET as the follow-up study. Both radiologists and nuclear medicine practitioners have incentives to shift examinations from conventional nuclear medicine to PET.

The next phase of PET development may well see existing scintigraphy applications replaced by PET. Around five million patients are currently examined using conventional nuclear medicine. Applications outside oncology may also stimulate the demand for PET but in the next five years the establishment of the technique will be underpinned by the rising demand from cancer patients.

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