For further information, please consult your personal doctor or contact the following:

**Department of Nuclear Medicine and Positron Emission Tomography**

**Hong Kong Sanatorium & Hospital**

2/F Li Shu Pui Block, 2 Village Road, Happy Valley, Hong Kong

Tel: 2835 8822
2835 8989

Fax: 2835 8825

Web site 網址: www.hksh.org.hk
The Hong Kong Sanatorium and Hospital is the leader in cancer treatment in the region. Its Oncology Centre has the most technologically advanced equipment available and can therefore provide the best treatment.

The Positron Emission Tomography (P.E.T.) scan is one of the most effective methods for imaging and diagnosis of cancer. The availability of such new technology will have a significant impact on the future management of cancer in Hong Kong.
P.E.T. is one of the most medically advanced tools in diagnosing disease. A P.E.T. scanner is literally a camera that can produce powerful images of the human body’s metabolic functions, thus revealing many of the mysteries surrounding health and disease.

Since metabolic changes occur before the functional and structural changes in the body’s tissues and organs, P.E.T. facilitates the early detection of cancer and also distinguishes malignant from benign diseases.

Simple compounds such as glucose, amino acid, or water are labelled with positron-emitting tracers. These are then injected into the patient to serve as biological imaging probes.

After a period of thirty minutes to an hour, when these compounds have been absorbed by the tissue, the patient is scanned with the P.E.T. scanner to pick up the signals from the tracers. These signals will reveal the distribution and activity of the tracers within various parts of the body.

The scanner’s computer converts these signals into metabolic images, which show the normal or diseased status of the tissues inside the body.
How are positron imaging agents prepared?
正電子掃描藥劑是怎樣來的？

1. The most advanced medical cyclotron – capable of producing positron emitters.
用以生產正電子同位素的最先進醫療加速器。

2. Positron emitters are combined in the computerized radiochemistry synthesizer with simple compounds such as glucose to become positron imaging prescriptions.
電腦化藥劑合成器將正電子同位素及簡單的化合物如葡萄糖等合成為正電子掃描藥劑。

3. Positron imaging prescriptions undergo strict quality control to ensure they have attained international quality standards.
正電子掃描藥劑經嚴格品質檢定，以確保合乎國際品質水平。

Does the patient have a hidden cancer and where is it?
病人是否患有隱藏的癌症？

P.E.T. has the ability to scan the entire body of a patient to determine whether the patient has concealed cancer.
正電子掃描能作全身的掃描並斷定病人是否患有隱藏的癌症。

Because cancer cells are generally highly metabolically active and divide rapidly, they consume 2-10 times more glucose than normal cells. Therefore, they appear as “hot spots” in the P.E.T. scan.
由於癌細胞一般會快速分裂，且新陳代謝特別活躍，攝取的葡萄糖是正常細胞的二至十倍，因此在正電子掃描影像圖上會現出明顯的「熱點」。
Is a tumour benign or malignant?

For example, about 80% of solitary pulmonary nodules are benign, but 20% are malignant. The P.E.T. scan has the ability to distinguish between malignant and benign nodules with 94% accuracy.

Has the cancer spread? (Staging of Cancer)

Cancer that spreads to other parts of the body (metastasis) also shows an increased glucose uptake that will also be detected by the P.E.T. scan.

This method of detecting hidden tumours within the body was never available in the past.
What if there is a recurrence of the cancer?

Recurrence of tumour is usually difficult to detect using traditional methods. One cannot treat what one cannot see and knows exist.

P.E.T. offers a new hope for patient so that any recurrence or metastasis can be detected earlier permitting further treatment likes surgery, chemotherapy and radiotherapy, which can be reapplied at an earlier stage.

Is the cancer treatment working?

P.E.T. scan can show the effectiveness of surgery, chemotherapy and radiotherapy in the treatment of cancer. Cancer that is successfully treated will no longer be metabolically active.

治療方法是否有效？

正電子掃描同時能顯示病人正在採用的癌症治療方法，如手術、化療及放射療等是否有效。因為當癌細胞受到控制時，患處的新陳代謝將變得不再活躍。

![Pre-therapy and Post-therapy scans](image)

**Fig 7**

圖7——一位四十二歲女士病者，曾經接受輸卵管卵巢切除手術及除卵巢癌。事後正電子掃描發現病者腦中有復發的淋巴結擴散點。

**Fig 8**

圖8——一名於肺部有多個轉移性癌腫瘤的病者，左圖：進行化療前顯示肺部有三個腫瘤。右圖：顯示經十個月後，化療使腫瘤成功消失。
How accurate is the use of P.E.T. scan in different cancers?

<table>
<thead>
<tr>
<th>Cancer Type</th>
<th>Sensitivity</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lung Cancer (Diagnosis of Solitary Lung Nodule)</td>
<td>96%</td>
<td>94%</td>
</tr>
<tr>
<td>Colo-rectal Cancer (Tumour Recurrence)</td>
<td>93%</td>
<td>95%</td>
</tr>
<tr>
<td>Breast Cancer (Detection of Metastasis)</td>
<td>85%</td>
<td>93%</td>
</tr>
<tr>
<td>Nasopharyngeal Carcinoma</td>
<td>88%</td>
<td>91%</td>
</tr>
<tr>
<td>Stomach Cancer</td>
<td>90%</td>
<td>90%</td>
</tr>
<tr>
<td>Pancreatic Cancer (Diagnosis of Primary)</td>
<td>95%</td>
<td>93%</td>
</tr>
</tbody>
</table>

A P.E.T. scan of the heart can be used to determine whether the patient is at the risk of heart attack by imaging the heart muscle perfusion during rest and during stress.

利用正電子掃描取得病人在鬆弛及運動狀態時的心肌灌注影像，能診斷病人是否會有突發心臟病的危險。

![PET imaging of the heart](image)

Fig. 9 - This patient survived a severe heart attack. Although there is decreased blood flow to the anterior wall (yellow colour in the 1st, 2nd & 4th row) This patient can be helped by angioplasty or coronary artery bypass graft operation.
A P.E.T. scan is also particularly helpful in determining whether there is any salvageable damaged myocardium (hibernating myocardium). This kind of myocardium still metabolizes glucose even though it appears not to be working.

With the modern advances in cardiology, such hibernating myocardium has a very good chance of regaining function after angioplasty or coronary artery by-pass graft operation. After such successful treatment, a patient’s cardiac function will show significant improvement.

Dementia

In neurology, a P.E.T. scan can show 3-dimensional images of blood flow in the brain for the diagnosis and monitoring of the progress of therapy in various neurological diseases such as Alzheimer's Dementia, Parkinson’s disease and Huntingdon's chorea.

痴呆症

在精神科方面，正電子掃描能提供腦部血液流動情況的 3-D 立體影像，協助診斷及監察各種精神科疾病，如早老性痴呆病、帕金遜病，及抗帕金遜氏舞蹈病等的治療進展。
**Epilepsy**

For some types of epilepsy patients, P.E.T. scans have been found to be of value in localizing the epileptogenic focus in the brain that causes epilepsy. By utilizing modern stereotaxic neurosurgery, this can be excised and results in a permanent cure for epileptic patients.

**Brain Tumours**

P.E.T. is a very useful tool in the management of patients with brain tumours. It can detect any recurrent brain tumour and distinguish it from fluid accumulation (oedema) after surgery or dead tissue (necrosis) after radiation treatment. It can also provide prognostic information by determining the malignancy grading of the tumour from metabolic activity prior to surgery.

Other more recent P.E.T. uses include imaging the brain blood flow reserve under stress to identify patients who are at risk from strokes and also to monitor any improvement after treatment.

**羊癇症**

對於某類羊癇症的病人，正電子掃描能夠清楚確定腦內導致羊癇症的根源部分，採用先進的腦立體測定腦科手術把羊癇症的根源切除，永久治癒。

**腦腫瘤**

正電子掃描亦是治療腦腫瘤的有效器材。它能檢測所有的復發腦腫瘤，同時可以辨別假腫瘤如手術後的水腫或放射治療後的壞死物。正電子掃描亦能透過腫瘤的新陳代謝活動，在手術之前診斷腫瘤所屬的惡性程度及展望手術成效。

其他用途包括攝取病人處於壓力下的腦部血液流動情況，找出有中風病發危機的病人，及跟查病人接受治療後的康復進度。

**Fig 11**

P.E.T. scan in a patient with temporal lobe seizure shows the area of abnormally decreased metabolism in the anterior left temporal lobe between seizures (arrow). Following surgical removal of the epileptogenic focus, the patient became seizure free.

**Fig 12**

A patient with malignant brain tumour who has received radiation to the right side of his brain. CT scan on the left shows post-radiation changes. P.E.T. scan on the right shows focal area (arrow) where tumour is still not yet destroyed.
HOW DO I PREPARE FOR THE TEST?
WHAT HAPPENS DURING A P.E.T. SCAN?

- An appointment has to be made by your doctor or yourself prior to the scan.
- You should fast for 4 hours prior to the scan.
- Inform us if you are pregnant or you think you might be pregnant; or if you are a nursing mother.
- You can take any prescribed medication on the day of your test unless you were instructed not to do so by your doctor.
- Let us know if you have diabetes. You should not take your anti-diabetic medication during fasting.
- Your blood glucose will be checked during the scan.
- P.E.T. compounds such as labelled glucose will be injected intravenously.
- 45 minutes after injection, you will lie on a scanning table. Then the P.E.T. scanner will scan the appropriate part of your body. The scan will take about 1 hour.
- You should allow 2.5 hours for the entire test.

CONCLUSION

P.E.T. is one of the most advanced medical tools for the detection and imaging of cancer, heart muscle evaluation and the examination of patients with dementia and epilepsy.

Its accuracy is 10-30% better than some conventional diagnostic methods and it has been shown that P.E.T. scans generally improve the management in 40-50% of patients.

正電子掃描是現今最先進的醫療技術之一，功能包括檢測及癌病掃描、診斷心肌性能、診斷痴呆症及羊癲發。

它比一般傳統的診斷方法準確度高10-30%，而且根據研究資料顯示，在40-50%的病患中，採用正電子掃描均能有助改善病人的療程。