Detecting Prostate Cancer Spread to Lymph Nodes Using Choline-PET Scan
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Advanced imaging is finding new uses in prostate cancer detection, and potentially contributing to saving lives in cases previously thought untreatable. An interesting example is the use of C-Choline-PET/CT scans to identify prostate cancer that has spread to the nearby lymph nodes.

Let's begin by understanding what lymph nodes are, and why they are a likely target for the early spread (metastasis) of prostate cancer that has left the gland. Just as your body has a network of arteries and veins that move blood around, it also has a separate network of vessels that contain a clear watery fluid called lymph. Lymph bathes cells, providing oxygen and nutrients, and it carries away waste. It also contains white blood cells that fight infection. Scattered throughout the lymph vessels are hundreds of filter points, called nodes, that "hold" substances picked up in the lymph fluid. After the fluid is "cleansed" it slowly continues on its way to the chest where it rejoins the bloodstream, leaving the offending substances in the nodes.

One area rich in lymph nodes is the region in the pelvic cavity, close to the prostate gland. If prostate cancer is left untreated, or if treatment misses some of the cancer, as cancer cells infiltrate beyond the edge of the capsule they will be picked up in the lymph and carried to regional nodes that try to combat them. Thus, a single lymph node or group of nodes in that area may swell or enlarge as they work to filter out the "bad" cells.

While no one knows exactly what percentage of prostate cancer patients have lymph node involvement at the time of treatment, or who is most at risk, a 2006 paper reported that in a group of 357 men with low-risk prostate cancer, a total of 35 (10%) were found to have suspected lymph node involvement. Of the 35, 19 had positive nodes outside the region where they would normally be taken during a conventional prostatectomy.[i]

To better understand the implications, let's take a hypothetical case of a man had a radical prostatectomy. His doctor says he got all the cancer, and for three years the patient's annual PSA test comes out 0.0 — in other words, no detectable PSA because the whole gland was removed. In the fourth year, his PSA comes back at 1.8. His doctor now knows that some microscopically small cancer had already escaped the capsule at the time of surgery. The patient would typically undergo tests to try to discover where the cancer is if it has already started to grow into a tumor: a bone scan (is it in the bone?) and a CT scan (is it in the lymph nodes or another organ?) If neither test reveals cancer activity, the doctor doesn't have many options. He puts the patient on hormone blockade therapy to temporarily stop the cancer in its tracks, and the patient learns to live with the side effects (see my article, "Hormone Blockade as a Prostate Cancer Strategy.").

On the other hand, studies have shown that if prostate cancer has spread to the lymph nodes and nowhere else, surgical removal of the nodes may save a patient's life,[ii,iii] and avoid hormone blockade. The problem is, how can we know which nodes contain the cancer? Ordinary CT scans miss the lesions because it can't pick them up when they're small.

A new study on the use of a specialized CT scanning technique called C-Choline-PET/CT may offer new hope to patients with lymph node metastasis.[iv] The study involved 72 patients with evidence of biochemical recurrence (rising PSA) after previous whole gland treatment, but no evidence of metastasis anywhere else in the body except for the regional lymph nodes. Each patient was scanned using this particular method, and then underwent surgical removal of the suspicious lymph nodes and nearby nodes, for a total of 2122 nodes. All removed lymph nodes were microscopically examined for the presence of cancer cells; the results were compared with the nodes revealed by imaging to contain evidence of tumor activity.

The findings were very encouraging, especially at the regional level. The C-Choline-PET/CT was shown to be 89.4% accurate (imaging matched the surgical specimens). Factors that diminished the accuracy were thought to be, among others, the size and diameter of the cancerous lesion, and certain locations. However, it was far more productive than an ordinary CT scan in identifying the pelvic lymph node regions containing the affected nodes. In fact, the Choline PET scan located positive lymph nodes small enough that they would have been considered pathologically insignificant on an ordinary CT scan. In other words, the information gained by such imaging could assist treatment planning aimed at potential cure: the surgical removal of a group of lymph nodes in a region where positive cancer spread was found.

This is a significant study. The authors suggest that if even one positive lymph node is discovered by C-Choline-PET/CT scan, nearby nodes in the same region be removed along with the identified node. In this way, the chances of a patient with limited lymph node metastasis achieving full recover are increased.

With research like this occurring, imaging continues to make strides in detecting cancer, and assisting in treatment planning.

[i] Weckerman D, Goppelt M, Dorn V et al. Incidence of positive pelvic lymph nodes in patients with prostate cancer, a prostate-specific antigen (PSA) level of < or =10 ng/mL and biopsy Gleason score of < or =6, and their influence on PSA progression-free survival after radical prostatectomy. BJU Int. 2006 Jun;97(6):1173-8.

[ii] Rigatti P, Suardi N, Briganti A. Pelvic/Retroperitoneal salvage lymph node dissection for patients treated with radical prostatectomy with biochemical recurrence and nodal recurrence detected by [11C]Choline Positron Emission Tomography/Computed Tomography. Eur Urol 2011;60:935-43.

[iii] Jilg CA, Rischke HC, Schultze-Seemann W. Salvage lymph node dissection with adjuvant radiotherapy for Choline-PET/CT positive lymph nodes in patients with nodal recurrence of prostate cancer. J Urol 2012 Dec;188(6):2190-7.

[iv] Jilg CA, Schultze-Seemann W, Drendel V et al. Detection of lymph node metastases in patients with nodal prostate cancer relapse using 18F/11C-choline-PET/CT - influence of size of nodal tumor infiltration and accuracy related to lymph node regions. J Urol 2014 Feb 8; pii:S0022-5347(14)00119-0 doi: 10.1016/j.juro.2013.12.054. [Epub ahead of print]