Acl reconstruction graft information

Economics

Graft report Patellar graft The patellar tendon bone-tendon-bone graft has been the " gold standard" graft choice for ACL reconstructions since it became common practice in the mid-1980. It has been used extensively by surgeons since that time and still remains the graft of choice for a high number of orthopedists who perform this surgery regularly. The patellar tendon graft has consistently demonstrated excellent surgical outcomes with a 90-95% success rate in terms of returning to pre-injury level of sports.

A patellar tendon graft is harvested through a 3-4" long incision based just along the medial border of the tendon... The middle third of the tendon 10-11 mm wide is then removed along with 2-2. 5 cm long bone blocks still apart of the tendon at each end of the graft from the tibial tubercle and the outer surface of the patella. This gives a composite bone-tendon-bone graft that has very strong insertion points of the tendon soft tissue into bone. The tensile strength of this graft has been measured by Noyes (1984) to be about 2950 Newton’s tofailure, versus the strength of an intact ACL at 2160 N.

What happens to the remaining patellar tendon after a third of it has been removed? Over the course of three to four months after surgery the tendon regenerates or " grows back". Initially it seems to overgrow into a thick, large tendon that then remodels back to a more normal contour by 12-18 months postoperatively. Surgeons have even been able to re-harvest another patellar tendon graft from the original tendon once enough time has passed for tendon reconstitution (although there's now evidence that this repaired tissue may not be as strong as normal patellar tendon tissue).

Patellar tendon ruptures at the donor site are unlikely after the first few months post-op. Patellar tendon ruptures can and do occur however during

the initial 6-8 weeks after surgery if the remaining tendon is stressed too hard. One of the advantages of this construct is that because the bone-tendon interface is quite strong, the surgeon only has to fix the block of bone in the bone tunnel rather than trying to fix the soft tissue itself.

A headless screw is inserted next to the bone plug (like a square peg in a round hole) to interference fit and locks the bone in place. The patellar tendon fibers are thereby immediately secured and are stable enough to begin motion and weight bearing when tolerated. The ends of the graft heal bone-to-bone in around 6-8 weeks, which appears to be quicker than the healing process for soft tissue-to-bone. Interference screws are now available in a bioresorbable material that actually dissolves within the bone over 2 to 3 years.

The " gold standard" graft isn't perfect, however. There may be more pain associated with this donor site than from any of the other graft choices. As a result there is sometimes a greater initial atrophy or wasting response of the quadriceps muscle compared to say either a hamstring or cadaver allograft. This can require more prolonged physical therapy to recover from and could possibly delay the initial return to sports. The incision (scar) is bigger, and almost all patients end up with a permanent loss of sensation 2-3" in size just lateral to the incision.

There is a risk of patellar tendon ruptures, as well as fracturing the patella both intraoperative as well as postoperatively, although bone grafting the defect in the patella at the time of surgery has reduced the incidence of the latter. Patients who kneel a lot for a living are often unhappy with the patellar tenderness and sensitivity that can occur at the incision site and

should probably consider an alternative graft choice. One of the bigger issues with patellar tendon grafts that recently has a number of orthopedists switching to alternative grafts is the incidence of anterior knee pain when patients try to resume athletic activities.

Specifically there are some studies5 showing an increased rate of patellofemoral pain and/or tendonitis of the patellar tendon with stairs, jumping, skiing and other such activities 6-12 months out from surgery. Ultimately these are often treatable with continued strengthening, rest from sports, and time, but these symptoms can delay the expected time of return to sports. In summary, the patellar tendon BTB graft is a safe and effective option for ACLreconstruction. It has a consistently successful clinical track record at all levels of athletic activity with excellent outcomes and reproducible results.

Its major disadvantages are primarily increased tenderness kneeling on the donor incision site, and the possible risk of problems with patellar and patellar tendon pain upon initial return to sports. Semitendinosus Semitendinosus grafts are made with the semitendinosus tendon either alone, or accompanied by the gracilis tendon for a stronger graft. The semitendinosus is an accessory hamstring (the primary hamstrings are left intact), and the gracilis is actually not a hamstring, but an accessory adductor (the primary adductors are left intact as well).

The two tendons are commonly combined and referred to as a four strand hamstring graft, made by a long piece. which is removed from each tendon. The tendon segments are folded and braided together to form a quadruple thickness strand for the replacement graft. The braided segment is threaded

through the heads of tibia and femur and its ends fixated with screws on the opposite sides of the two bones. Hamstring grafts require a smaller incision and are usually less painful to harvest.

Thus the initial postoperative period is often easier and more comfortable with this graft choice. Similarly, because there is no violation of the patellar tendon, there seem to be fewer problems with knee pain during the first few months that a patient is allowed to return to sports. The hamstring incision is away from the patella so patients are usually comfortable kneeling after their reconstruction. Because the quadriceps extensor mechanism isn't violated with a hamstring harvest there is often less initial quadriceps atrophy.

With a quicker return of knee quadriceps strength some surgeons are allowing their fully recovered patients to return to sports a month or two earlier than they might for a patellar tendon BTB graft.. However there have not been any scientific studies examining the tensile strength to failure of a human ACL graft at three months after implantation that would support this approach. Certainly the animal research done on patellar tendon tensile strength in rhesus monkeys suggested that the graft was actually weakest at 3 months out before maturing at 6 months post-surgery.

However the truth is that soft tissue-to-bone healing occurs at a slower rate than bone-to-bone healing. A number of surgeons are concerned that this fact is being ignored when patients are placed into an accelerated rehab without allowing extra time for the graft ends to begin to heal to the bone tunnels another disadvantage of hamstring tendon grafts is that harvesting them is a technically demanding procedure that requires considerable surgical experience. Pitfalls such as transecting (cutting in half) a tendon or

injuring nerves or ligaments in the area of dissection are possible during the stripping process.

There is also a different technique for tensioning the hamstring tendon in the knee once the femoral end has been secured. The graft needs to be pre-tensioned and it's important that each of the four graft ends be individually tensioned during the tibial fixation for best results. Allographs Another alternative available however is to use tissue from a cadaver that is called an allograft. Patellar tendon, hamstring tendon, and even Achilles tendon allografts can be used as ACL graft tissues and are inserted and fixed with the same techniques that are used for autografts.

The advantages of using cadaver graft tissue are obvious; no risks, pain, or scars from the donor site. Surgical time is quicker and because there is considerably less discomfort postoperatively, the incidence of joint stiffness and atrophy of the quadriceps muscle is significantly reduced. Allografts are a good choice when there are limitations in a patient's own tissue availability. Complicated multiple ligament reconstructions needing several grafts routinely require the use of allograft tissue in addition to an autograft.

Revision ACL reconstructions where an autograft has already been harvested are also an indication for using a cadaver grafts.. The biggest concern with using allografts is the risk of contracting a serious infection from the cadaveric tissue. Hepatitis and HIV can be transmitted through these tissues with potentially fatal outcomes. Bacterial infections are also a possibility and although not usually life threatening, can result in loss of the graft and cause subsequent arthritis. The dilemma with allografts is that they can't be 100%

sterilized without altering or even destroying the tensile strength of the graft tissue.

Imagine what happens to anyfoodthat is pressure-cooked at temperatures over 270° F under pressure for 10 minutes and you'll understand what happens to a patellar tendon graft sterilized in an autoclave. Similarly, radiating grafts with high enough doses to kill viruses has been shown to alter the collagen tissue and reduce the graft's tensile strength. Currently the preferred allograft treatment technique is a fresh frozen graft; the tissue is harvested, cleaned and then frozen in liquid nitrogen.

The cadaver is screened extensively with hepatitis and HIV testing as well as a life style analysis to identify any high-risk behavior for these illnesses. Blood tests for HIV, however, are not infallible because they can lag 6 months between the time of infection and the conversion to a positive test. Nevertheless, the process is fairly safe and the published rate of contracting HIV from these tissue allografts is between 1 in 1. 2 to 2 million. There are some graft procurement companies who are able to do actual direct HIV viral testing on their tissues which lowers the risks even more.

And several companies have developed proprietary cleaning techniques that they claim can guarantee sterility of their graft tissues. Some grafts are also treated with low dose irradiation (1-2 Mrads) in a compromise attempt to provide some degree of sterilization without damaging the tissue characteristics. Unfortunately there are some studies indicating that ACL reconstructions using these tissues may stretch out over time so non-irradiated grafts would be the ideal structural choice if infection were not a concern.

Unlike organ transplants, allografts aren't usually at risk for tissue rejection by the host. This is because there's very little protein antigen in these washed grafts (the bone ends are completely cleansed of any marrow elements). The majority of the grafts are primarily made up of collagen, which has very low antigenicity. Laboratory studies have shown that there is universally a low grade immune reaction to insertion of these foreign tissues, but this doesn't appear to be clinically significant in terms of achieving a successful outcome.

Bone tunnel widening is sometimes seen with the use of allografts, but similar to the case of hamstring grafts, doesn't seem to have any significance in terms of functional problems. There are some early studies suggesting that allografts take longer to heal in the knee than comparable autograft tissue. At the same time the patient is recovering from the surgery quicker because of the reduced pain and morbidity of not having donated their own graft tissue. Typically allograft patients will feel like they're ready to get back into sports in just 3 or 4 months since their full strength and joint mobility are often achieved at that point.

The combination of delayed allograft incorporation with an accelerated recovery can obviously spell disaster in terms of the ACL graft stretching or rupturing altogether. So patients with allografts must completely understand the healing process and comply with the temporary restrictions even though they may think their bodies are telling them it's OK to be doing more athletically. It takes a lot of mental discipline. And obviously it's a misconception that an athlete can return to sports earlier using an allograft

in view of the above. The last disadvantage of allografts relates to the practical issues of cost and availability.

There has been a national shortage of patellar tendon allografts due to increasing demand combined a low supply of suitably qualified cadavers. This shortage has been created in part by physicians who routinely use allografts as their first choice for ACL reconstruction grafts in spite of the fact that autograft tissues work wonderfully. Other cadaveric tissues such as hamstrings, Achilles tendons, and even anterior tibialis and posterior tibialis tendons (some of the ankle tendons) are often being used instead of patellar tendons due to this availability issue.

Some surgeons simply don't have ready access to the facilities that procure and process allografts. And allografts are expensive, running anywhere from $2000 to $10, 000 depending on the tissue type and your geographic location My Choice If I needed to go into surgery for an ACL reconstruction surgery and I had to choose from one of these graft options, I would choose to go with the semitendinosus graft. I would shy away from the allograft mainly because I am uncomfortable with the whole idea of donor replacements being implanted in my body.

Along with the great threat of infection the allograft also tends to be hard to obtain with a nationwide shortage of acceptable cadavers, therefore making them very expensive. When comparing the patellar graft and the semitendinosus graft its hard to find much of a difference in the results, both offer good knee stability with minimal adverse effects after surgery. However, the semitendinosus graft affects a much different and less major

tendon group, in return providing less knee related problems after surgery therefore giving it the advantage over the patellar graft in my eyes.