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# BEYOND CADAVERIC DISSECTION: A MULTIMODAL APPROACH TO POSTGRADUATE SHAREERA RACHANA EDUCATION IN AYURVEDA

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## ABSTRACT

Background: Shareera Rachana is one of the basic subjects through which an Ayurveda student begins to understand the structure of the human body. For generations, cadaveric dissection has been at the heart of anatomy learning. The experience of seeing, touching and tracing structures in a cadaver gives an understanding that is difficult to obtain from books alone. At the same time, the way anatomy can be studied today has changed considerably. CT and MRI images, ultrasonography, three-dimensional models, digital histology and virtual learning resources can now show the human body from different viewpoints. For a postgraduate scholar, exposure to some of these methods may add another dimension to the knowledge gained through dissection. Objective: To discuss how different methods of learning anatomy can be brought together in postgraduate Shareera Rachana education without losing the importance of cadaveric dissection and traditional methods of teaching. Materials

and Methods: This narrative review was prepared by referring to published literature related to anatomy education, cadaveric dissection, radiological anatomy, three-dimensional learning, ultrasound and virtual anatomy education. These observations were considered from the point of view of postgraduate teaching and learning in Shareera Rachana. Discussion: No single method can show every aspect of the human body equally well. A cadaver allows a student to appreciate actual structures and their relationships, while imaging shows the body in the living state and in different sections. Surface anatomy connects deeper structures with the living body, while three-dimensional and digital resources may make certain difficult regions easier to visualise. Bringing these methods together may therefore make postgraduate anatomy learning more complete. The experience of teachers remains central to this process, because newer learning tools become useful only when they are placed in the right anatomical context by a knowledgeable teacher. Conclusion: Going beyond cadaveric dissection does not mean moving away from dissection. It means adding suitable learning experiences around it. A balanced combination of cadaveric study, living anatomy, imaging, microscopic anatomy and selected digital resources may help postgraduate scholars understand anatomy in a broader and more applied manner.

**KEYWORDS**: Shareera Rachana, cadaveric dissection, postgraduate education, anatomy teaching, multimodal learning, radiological anatomy, Ayurveda.

## INTRODUCTION

For most students of medicine, anatomy is one of the first subjects through which the human body begins to make sense. In Ayurveda, Shareera Rachana introduces the student to the structural understanding of the body while also providing an opportunity to study the descriptions available in the classical texts.

Cadaveric dissection has always had a special place in this learning process. There is a difference between reading that a nerve passes between two structures and actually finding that nerve during dissection. There is also a difference between looking at a beautifully labelled illustration and seeing how structures are arranged in a real human body. It is during dissection that many anatomical relationships which appear complicated in a textbook gradually become clear.

For this reason, cadaveric dissection cannot simply be replaced by another method. However,

the human body can now be studied in ways that were not easily available to students in the past. CT and MRI allow us to look at the body section by section. Ultrasonography can demonstrate certain structures in a living person.

Three-dimensional models allow difficult anatomical regions to be viewed from different directions. Digital histology can bring microscopic structures onto a common screen for discussion.

Each method tells us something slightly different about the same human body. Estai and Bunt, while reviewing teaching practices in anatomy education, pointed out that anatomy is best taught by selecting methods according to the learning requirement rather than depending upon one teaching method alone.[1] This appears particularly meaningful at the postgraduate level.

A postgraduate scholar in Shareera Rachana is expected to go a little further than simply identifying a structure and describing its attachments or relations. The scholar gradually takes on the roles of a teacher, researcher and academician. This requires the ability to look at anatomy from more than one perspective.

Therefore, the question may not be whether cadaveric dissection or newer methods are better. A more useful question would be: How can we use them together? This article attempts to look at that possibility from the perspective of postgraduate Shareera Rachana education.

**WHY THINK BEYOND A SINGLE METHOD?**

Every method of learning anatomy has its own strength. A cadaver teaches anatomy in a way that a computer screen cannot. At the same time, a preserved cadaver cannot show the movement of a joint in a living person or the appearance of an organ on an MRI.

A textbook illustration can make a complicated region look simple, but the same region may appear very different when a student encounters it during dissection. This is probably why students sometimes know a structure very well in one setting but struggle to recognise it in another.

A student may confidently identify the kidney in a dissected specimen and yet initially find it difficult to identify the same kidney in an axial CT section. Similarly, a student who knows all the attachments of the muscles around the shoulder may still benefit from watching those

structures work together during actual movement.

Multimodal learning simply tries to bring these different experiences closer together. For example, while studying the knee joint, a postgraduate scholar could first revise its anatomical description, study the bones and ligaments in the dissection hall, observe the movements of the joint in a living person and later look at an MRI of the same region. None of these activities has to compete with the others. Instead, each one may fill a small gap left by another.

Studies on three-dimensional visualisation have shown encouraging results, particularly in the understanding of spatial anatomy.[2] Integration of radiological images with anatomy teaching has similarly been explored as a way of making anatomical knowledge more clinically meaningful.[3] For postgraduate Shareera Rachana, such an approach may provide an opportunity to move from simply knowing anatomy towards seeing, interpreting and applying anatomy.

**CADAVERIC DISSECTION SHOULD REMAIN AT THE CENTRE**

When discussing newer methods of anatomy teaching, there is sometimes a tendency to place conventional and digital methods on opposite sides. That may not be necessary.

Cadaveric dissection continues to offer something unique. While dissecting, a student learns that the human body does not always resemble the perfectly arranged diagrams found in textbooks. Structures may vary. A vessel may follow a slightly different course. A muscle may have an additional slip. Sometimes a structure is difficult to find and requires patience. These experiences themselves are part of learning anatomy.

Dissection also develops careful observation and the ability to work with one's hands. More importantly, it gives the student a sense of respect towards the human body and towards the person whose body has made that learning possible.

For a postgraduate scholar who may later teach anatomy, repeated exposure to dissection is particularly important. A teacher needs to be comfortable not only with the standard description of a structure but also with the variations that may appear on the dissection table. At the same time, preservation changes the colour, texture and flexibility of tissues.

Movement and circulation cannot be observed in the same way as in a living individual. This is where other methods become helpful.

A systematic review of virtual technologies used for anatomy teaching has shown promising educational outcomes, but such technologies cannot reproduce all the practical experiences associated with actual dissection.[4] Therefore, the idea of multimodal learning should not be interpreted as "cadaver versus technology." It is better understood as "cadaver plus other useful ways of seeing anatomy."

## SEEING ANATOMY THROUGH CT AND MRI

One area that may be especially useful for postgraduate scholars is radiological anatomy. During dissection, we usually approach the body by removing structures layer by layer. In a CT or MRI, however, the same body appears as a series of sections.

At first, this change in perspective can be confusing. A student who has seen the liver many times in the dissection hall may still need some practice before comfortably recognising its different parts in successive CT sections. But once the two are connected, sectional anatomy begins to make much more sense.

Radiological anatomy does not have to mean that a Shareera Rachana postgraduate should learn to report scans like a radiologist. That is neither necessary nor the purpose. The aim can be much simpler: to recognise normal anatomy in commonly used images.

For example, after dissecting the abdomen, students could sit together and identify the liver, spleen, kidneys, pancreas, aorta and inferior vena cava on selected CT images. Similarly, MRI images could be shown while studying the brain, spinal cord, knee or shoulder.

Heptonstall and colleagues have discussed the value of bringing radiology and anatomy teaching together, particularly in making anatomical learning more relevant to later clinical understanding.[3] For Shareera Rachana postgraduates, even a small number of carefully selected imaging sessions during each region of study could make a meaningful difference.

## FROM THE DISSECTION TABLE TO THE LIVING BODY

There is another simple resource available to every anatomy department - the living human body. Surface anatomy sometimes receives less attention once students become deeply involved in cadaveric study. Yet it provides an important link between what is seen inside the body and what can be identified from outside.

Consider something as simple as the cubital fossa. A student can dissect the region and study all its contents. Later, on a living individual, the student can identify the superficial veins, feel the arterial pulse and observe the tendons that become prominent during movement. Suddenly, the region is no longer just a dissected triangular space. It becomes part of a living person.

The same can be done with joints, muscles, bony landmarks and superficial vessels. Ultrasonography can take this one step further. Under proper supervision, ultrasound can allow students to observe selected muscles, tendons, vessels and other superficial structures in real time.

A systematic review of ultrasound in undergraduate medical anatomy education described its potential to support active learning and help connect anatomical structures with the living body, while also noting practical challenges in implementation.[5]

This does not mean that every postgraduate scholar needs extensive ultrasound training. Even a few demonstrations conducted with the help of colleagues who are already experienced in ultrasonography may be sufficient to open a new way of looking at anatomy.

**WHEN A TWO-DIMENSIONAL PICTURE IS NOT ENOUGH**

Anyone who has tried to learn the base of the skull, pelvic spaces or some of the cranial nerve pathways from a flat diagram knows how difficult spatial anatomy can become. Sometimes the student understands every individual structure but still cannot imagine how they are arranged in three dimensions.

This is where three-dimensional models can be useful. A digital model can be rotated. Structures can be viewed from above, below or behind. Certain layers can be temporarily removed so that deeper relationships become easier to appreciate.

A meta-analysis by Yammine and Violato reported that three-dimensional visualisation technologies can support anatomical learning, particularly spatial knowledge.[2] These models may therefore be particularly helpful for regions that students repeatedly find difficult.

The brachial plexus is a good example. A postgraduate scholar could first study it in a diagram, then trace it in a cadaver and finally use a three-dimensional model to revise the relationship of its roots, trunks, divisions, cords and branches.

The important point is that the model should support the cadaveric experience rather than become a substitute for it. Not every anatomical topic needs a three-dimensional application. Sometimes a bone in the hand and a good teacher explaining it are more useful than sophisticated software. The learning objective should decide the method not the novelty of the technology.

## VIRTUAL DISSECTION: AN ADDITIONAL WINDOW INTO ANATOMY

Virtual dissection platforms allow students to explore digitally reconstructed human anatomy. Layers can be removed, structures isolated and the body viewed in different sections. Virtual reality and augmented reality have further expanded these possibilities.

Systematic reviews examining these technologies have reported encouraging results, although the outcomes vary according to the technology, learning objectives and the way the method is used.[4,6]

For a postgraduate department, virtual anatomy need not become a separate subject. It could simply become another resource. A student might use a virtual model before entering the dissection hall to understand the basic arrangement of a difficult region. After completing the dissection, the same resource could be used to revise structures that were difficult to visualise.

Used in this way, virtual anatomy becomes less of a replacement and more of a before-and-after companion to dissection.

## MICROSCOPIC ANATOMY CAN ALSO BECOME MORE INTERACTIVE

Gross anatomy and microscopic anatomy are often learnt as separate parts of the subject, although they describe different levels of the same structure. Digital histology provides an opportunity to bring them closer together.

A digital slide can be projected on a screen so that the teacher and students are looking at exactly the same field. Areas of interest can be enlarged and discussed together.

Imagine studying the kidney as one continuous learning experience. First, the student sees and handles the kidney during dissection. Then its internal features are studied in a specimen. A CT image demonstrates its position in the living body. Finally, the glomerulus and renal

tubules are studied microscopically. The organ is no longer learnt in disconnected pieces. The same approach can be applied to the liver, gastrointestinal tract, respiratory system, reproductive organs and nervous system. Conventional microscopy should certainly continue, because handling a microscope and identifying tissues independently are valuable skills. Digital histology can simply provide another opportunity for discussion and revision.

**WHERE DOES AYURVEDA FIT INTO THIS?**

This is perhaps the most important question for Shareera Rachana. If multimodal education merely adds CT images and computer models to the existing syllabus, it may improve anatomy teaching, but it will not necessarily strengthen the distinctive academic character of Shareera Rachana.

The classical anatomical descriptions must remain part of the discussion. Descriptions related to Asthi, Sandhi, Peshi, Snayu, Sira, Dhamani, Srotas and Marma offer many possibilities for postgraduate study.

Modern methods can sometimes help us look at these descriptions from another angle. For example, while studying a Marma region, a scholar may begin with the classical description, identify the region on the body, study the structures present there in a cadaver and then look at appropriate imaging when useful.

But some caution is necessary here. There is a natural temptation to find a modern anatomical equivalent for every classical term. Sometimes the relationship may be convincing. At other times, it may not be.

It may be more academically sound to say that a classical concept has a possible anatomical relationship and investigate it carefully rather than deciding beforehand that two terms are identical. This itself can become an important lesson for postgraduate scholars: correlation should follow observation; observation should not be forced to fit a correlation.

A multimodal approach may therefore be useful not only for teaching but also for developing better research questions in Shareera Rachana.

**BRINGING CLINICAL RELEVANCE INTO ANATOMY**

Students often remember anatomy better when they understand why a particular relationship matters. The course of the sciatic nerve becomes more interesting when its practical

importance is discussed. The anatomy of the nasal cavity becomes easier to remember when its applied aspects are considered. The vertebral column becomes more meaningful when sectional images are viewed along with the bones and specimens.

This does not mean turning Shareera Rachana into a clinical department. The purpose is simply to allow anatomy to communicate with the subjects that use it.

Occasional academic interaction with Shalya Tantra, Shalakya Tantra, Panchakarma, radiology or other relevant departments could be useful. Such sessions may also allow postgraduate scholars to hear the same anatomy explained from another professional point of view.

Literature on integrated anatomical sciences supports the value of connecting foundational anatomical knowledge with clinical applications.[7] For postgraduate scholars who are likely to become teachers themselves, these interactions may also provide useful examples that can later be brought into undergraduate teaching.

## A POSSIBLE MULTIMODAL MODEL FOR PG SHAREERA RACHANA

A multimodal curriculum does not mean that every department has to purchase expensive equipment. In fact, much can be done with resources that are already available in many institutions. The following model is therefore suggested as a flexible framework rather than a compulsory pattern.

**Table 1: A suggested multimodal framework for postgraduate Shareera Rachana learning. The framework is proposed for academic discussion and is not presented as an existing regulatory curriculum.**

| Area of learning | What could be done | What it may add to learning |
|---|---|---|
| Classical Shareera Rachana | Text reading, discussion and comparison of descriptions | Stronger understanding of the Ayurvedic foundation |
| Cadaveric anatomy | Dissection, demonstration and observation of variations | Direct understanding of structures and relationships |
| Living anatomy | Surface marking, palpation and observation of movement | Connects the dissected body with the living body |
| Radiological anatomy | Selected X-ray, CT and MRI discussions | Helps students understand sectional and living anatomy |
| Ultrasonography | Occasional supervised demonstrations | Provides a real-time view of selected structures |
| 3D models | Used for selected difficult anatomical regions | Helps in understanding spatial relationships |

| | | |
|---|---|---|
| Virtual anatomy | Optional preparation and revision around dissection | Provides another way of revisiting complex regions |
| Histology | Conventional microscopy supported by digital slides | Connects gross and microscopic structure |
| Applied anatomy | Case discussions and interaction with relevant departments | Shows why anatomical relationships matter |
| Research activities | Anatomical documentation, measurements and small projects | Encourages observation and research thinking |

The important word here is flexibility. One institution may have excellent radiological facilities but no virtual dissection table. Another may have a strong dissection facility and a collection of good specimens but limited digital resources. Both can still practise multimodal teaching. The aim is not to make every department look the same. The aim is to make the best educational use of what is reasonably available.

**THE TEACHER REMAINS AT THE CENTRE OF THIS APPROACH**

When new technologies enter education, there can sometimes be an impression that teachers are expected to constantly replace familiar methods with new ones. That is not the intention of the present proposal.

In anatomy, the experience accumulated by a teacher over years of dissection, specimen preparation and classroom interaction has enormous value. A digital model can show a structure, but it cannot replace the observations of a teacher who has seen that structure repeatedly in different cadavers.

Similarly, software can label a nerve, but an experienced anatomy teacher can explain why the nerve is important, how its relationship changes within a region, what variations have been observed and where students commonly become confused.

Newer tools are therefore most useful when they work in the hands of experienced teachers - not when they attempt to replace them.

It is also neither necessary nor practical for every teacher to become an expert in every new technology. A department can work as a team. A faculty member who is comfortable with imaging may conduct an image-based discussion. Another who has extensive dissection experience may guide cadaveric sessions. Someone interested in digital resources may help prepare three-dimensional or virtual learning material.

Senior teachers, in particular, bring something that cannot be quickly acquired through software training: years of anatomical observation, teaching experience and judgement. Their role can therefore be one of guidance and academic leadership. Younger faculty members and postgraduate scholars who are comfortable with newer digital platforms can assist with the technical aspects where required.

This creates an opportunity for learning in both directions. The experience of senior teachers can guide the use of technology, while younger faculty and students can make the technology easier to access. In this way, introducing newer learning methods need not place an additional burden on teachers. It can instead become a collaborative activity within the department.

**HOW SHOULD STUDENTS BE ASSESSED?**

If students learn anatomy in different ways, assessment can also gradually include some of these perspectives. Traditional theory and practical examinations remain important.

Along with them, a postgraduate scholar could occasionally be asked to identify a structure in a cadaver and then recognise the same structure in a CT or MRI image. A student could be shown a surface landmark and asked to explain the deeper anatomical structures. Seminars could include a small imaging or applied anatomy component.

Postgraduates could also maintain a collection of interesting anatomical variations encountered during dissection. These need not necessarily become additional major examinations. Many of them could form part of regular departmental academic activities and formative assessment.

The intention should be to see whether the scholar can use anatomical knowledge, rather than simply remember more information.

**PRACTICAL DIFFICULTIES CANNOT BE IGNORED**

Any suggestion for curriculum improvement must also consider what is practically possible. Not every institution will have a virtual dissection table, advanced simulation laboratory or access to expensive anatomy software. That should not become a disadvantage.

Multimodal learning can begin with very simple steps: a few good CT images during a regional anatomy discussion, surface anatomy demonstrations, digital photographs of interesting dissections, interaction with another department or a collection of well-organised

histology images.

The second concern is time. Postgraduate scholars already have teaching responsibilities, seminars, practical work, dissertation activities and examinations. Adding too many separate sessions may create more pressure without necessarily improving learning.

Therefore, newer methods should preferably be woven into what is already being taught. For example, CT images of the abdomen can be discussed during abdominal anatomy itself rather than creating an entirely separate course.

Cost, maintenance and access to technology are additional considerations. These factors suggest that multimodal education should develop gradually according to the resources and needs of each institution.

There is little educational value in introducing technology simply because it is new. A simple method that helps a student understand is more valuable than an advanced method that is rarely used.

**DISCUSSION**

Postgraduate education should ideally change the way a scholar looks at a subject. During undergraduate study, much of the effort naturally goes into learning the large amount of anatomical information that is required. At postgraduate level, the questions begin to change.

Why is the structure arranged this way? How does it appear in another individual? Can I recognise it in a sectional image? How can I explain this to a student? Can this observation become a research question?

A multimodal approach may help in asking some of these questions. Available studies suggest that three-dimensional visualisation, imaging-based anatomy and virtual learning can be useful additions to anatomical education.[2,3,6] However, much of this evidence comes from undergraduate medical and health-science education.

It would therefore be incorrect to assume that the same results will automatically occur in postgraduate Shareera Rachana. This is also an opportunity. Ayurveda institutions can begin studying these methods in their own educational setting rather than simply adopting them because they have been used elsewhere.

For example, one department could examine whether adding sectional imaging improves postgraduate understanding of abdominal anatomy. Another could evaluate whether a combination of classical textual discussion, cadaveric observation and surface anatomy improves the understanding of selected Marma regions. Such small educational studies could gradually provide evidence that is actually relevant to Shareera Rachana.

At the same time, the strength of existing teaching should not be overlooked. Many experienced anatomy teachers have taught generations of students effectively with cadavers, specimens, bones, blackboards and carefully drawn diagrams. The purpose of multimodal education is not to suggest that those methods were inadequate.

Rather, today's postgraduate scholar has access to a few additional windows through which the same human body can be viewed. The challenge is to open those windows without closing the old ones.

**RECOMMENDATIONS**

A practical way forward may be to keep cadaveric dissection as the foundation and gradually add selected complementary methods according to institutional facilities.

Radiological anatomy can be introduced through a small number of carefully selected images during regular regional anatomy teaching. Living and surface anatomy can be strengthened without major additional infrastructure. Three-dimensional or virtual resources may be used mainly for difficult regions where they genuinely make understanding easier.

Interaction with other departments can be encouraged wherever it adds anatomical relevance. Importantly, senior and experienced faculty should continue to guide the academic content and anatomical interpretation. Technologically comfortable faculty members and postgraduate scholars can assist in accessing and preparing newer resources.

Institutions should not be expected to adopt every available technology. Instead, each department may identify two or three methods that genuinely add value to its existing teaching and develop them gradually.

Finally, these approaches should be evaluated within Ayurveda institutions themselves so that future curriculum decisions can be based on experience and evidence from Shareera Rachana

education.

## CONCLUSION

Cadaveric dissection has shaped the way anatomy has been learnt and taught for generations. Even with the availability of advanced technology, its educational value remains difficult to replace.

But the possibilities around the dissection table have increased. Today, the structure seen in a cadaver can also be looked at in a living person, followed through a CT scan, examined on an MRI, viewed under a microscope and reconstructed as a three-dimensional image.

For a postgraduate scholar, seeing the same anatomy in these different ways may help individual pieces of knowledge come together.

This does not require abandoning familiar methods or asking every teacher to become a technology expert. It requires something much simpler - a willingness to use an additional method when that method genuinely makes anatomy easier to understand.

The experience of senior teachers, the curiosity of postgraduate scholars, the strength of cadaveric learning and the sensible use of newer resources can complement one another.

Perhaps that is what “beyond cadaveric dissection” should really mean. Not leaving the dissection hall behind, but carrying what we learn there into the living body, the radiological image, the microscope, the classroom and eventually into research.

In this sense, the future of postgraduate Shareera Rachana may not be purely traditional or purely digital. It can be a thoughtful meeting of both.

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