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Review Article

Radiology Section

An Imaging Enquiry into Prostatic Calcifications

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ABSTRACT

While the prostate is known to have calcifications, many times the exact etiology is unknown. It's relation with infections or neoplasms is also not clear. While it can come as a surprise for the novice, an expert might feel otherwise and may even pass is as an incidental finding.

Often these calcifications are tiny and cannot be palpated and hence, remain practically hidden. However, they become readily visible on ultrasound scan- the most widely used imaging modality; as hyperechoic foci with or without posterior acoustic shadowing. They can also be detected on CT-scan or MRI-scans. On CT-scan the calcifications appear as tiny hyperdense foci having CT density value +90 to +150 H.U. MRI demonstrates them as hypointense foci on all MRI sequences, seen best on gradient echo sequence. Plain Radiographs will show them only when they are sufficiently large or radio-opaque as radio-opacities in the expected locations of these organs.

The aim of this article is to describe the lesser known phenomenon of calcifications in prostate; to ascertain the causes and to address to the health impacts of these calcifications.

Keywords: Calcifications, CT scan, Diagnostic Imaging, Prostate

INTRODUCTION

Prostate is an organ associated with the male genital system. It provides the vital prostatic fluid to the semen that contains sperm which have the capability to give life to new human beings after uniting with the ovum from a female. Urethra too passes through the prostate.

Normal prostate is devoid of calcifications. But with advances in imaging modalities, prostatic calcifications are being increasingly detected due to a variety of causes. This article aims to describe the lesser known phenomenon of calcifications in prostate; to ascertain the causes and to address to the health impacts of these calcifications

Prostatic calcification is most commonly encountered as calculus or intraluminal calcifications within atypical small glandular proliferations.

The Aetio-pathogenesis of Prostatic Calcifications

The processes of calcifications in prostate are still under study and efforts are still being made on these fronts as newer inputs keep pouring. Based upon their etiology, calcifications in prostate can be classified as Idiopathic / Primary (when the cause is unknown) and Acquired / Secondary (when some cause is known) as described in detail in [Table/Fig-1].

Thus, a variety of etiologies either singly or hand in hand go to the formation of Prostatic calcifications.

Autopsy reports of men over 50 have found prostatic calculi in 70-100% cases [1]. Secretions of prostate get calcified to form these calculi. Sometimes, corpora amylacea may also get calcified and result into prostatic calculi.

Though, the prostatic calculi may be present, they do not cause any symptoms. An association of hyperparathyroidism and large sized calculi (> 3 cm^2) has been reported [2].

No	Cause of Calcification	Prostate
I	Idiopathic / Primary	Commonest
II	Acquired / Secondary	Less Common
IIA	Traumatic	Direct or Indirect Trauma, Dystrophic Calcifications
IIB	Infective/ Inflammatory	Bacterial > Viral >Fungal
IIC	Neoplastic	Adenocarcinoma
IID	Vascular	Diabetes Mineralizing Angiopathy

[Table/Fig-1]: Causes of calcifications in prostate.

Prostatic calcifications occur in 7-10% of patients with benign prostate hyperplasia. Patholologists believe that primary prostatic calcification develops by calcification of corpora amylacea which are small round or ovoid bodies seen in the lumen of the prostatic acini, which may be derived from desquamated epithelial cells and proteinaceous material [1]. In has been demonstrated that acute inflammatory proteins constitute the organic matrix of prostatic corpora amylacea and calculi showing that the most prevalent protein is lactoferrin and that several other proteins are components of neutrophil granules. These results provide intriguing evidence for the role of acute inflammation in the biogenesis and the process of corpora amylacea and even prostatic calculi, an observation that may give important insight into the frequency of asymptomatic acute inflammation in the prostate and a potential contributing factor to prostate carcinogenesis [3].

The exact mechanism of prostatic calcification formation is at the moment still unknown. Nevertheless it has been proposed that prostatic infections, urinary retention or reflux into the prostate, penetration of spermatozoa into prostatic tissue, and desquamation of prostatic epithelium could be the contributing factors [3].

A recent multi-centric, cohort, observational, study [4] showed the incidence rate of prostatitis to be 13.7 % with quite a high prevalence of bacterial prostatitis about 13.3%, probably due to the application of systematic microbiological diagnostic criteria on all patients if compared with 2.9% of the controls ($p< 0.001$). In the same study intra-prostatic calcifications were found in 59% of the patients and 1% of the controls ($p<0.001$).

It has already been proved that bacteria isolated in prostatitis are able to form biofilm in approximately 85% of the studied strains [5]. This represented the starting point to investigate if prostatic calcifications could also be biofilm related. These researchers aimed to characterize the prostate calcifications by scanning electron microscope and perform a correlation with bacterial biofilm obtained from patients with chronic bacterial prostatitis. They observed that majority of *E. coli*, gram negatives, *Staphylococci* and Enterococcal strains were biofilm strong or medium producer. Globally 84.6% of the strains produced a consistent biofilm (strong or medium producer). It was also demonstrated that the ultra structure of prostatic calcification was identical with the micro-structure of the biofilm formed “in vitro” from bacteria obtained from patients of chronic prostatitis.

An electron microscopy study has also demonstrated that the in vivo prostate calcification ultra structure is identical to biofilm microstructure formed in vitro from bacteria obtained from chronic prostatitis patients [6]. Thus, it was conclusively proven for the first time that bacteria can be involved in prostatic calcification formation and that bacterial ethiogenesis is strictly connected to tissue inflammation and potentially at prostate cancerogenesis.

It is known that calcifications in the prostate are common more so with the increasing age, but till date the relationship between calcifications and prostate cancer is not clearly documented [7]. Benign prostate gland and prostatic stroma in all zones as well as the verumontanum are the common sites of prostatic calcifications. Hence, prostatectomy specimens of benign hyperplasia of prostate show such calcifications in plenty. Calcifications in prostate are important because sooner or later; they lead to formation of prostatic calculi which can adversely affect the health of an individual.

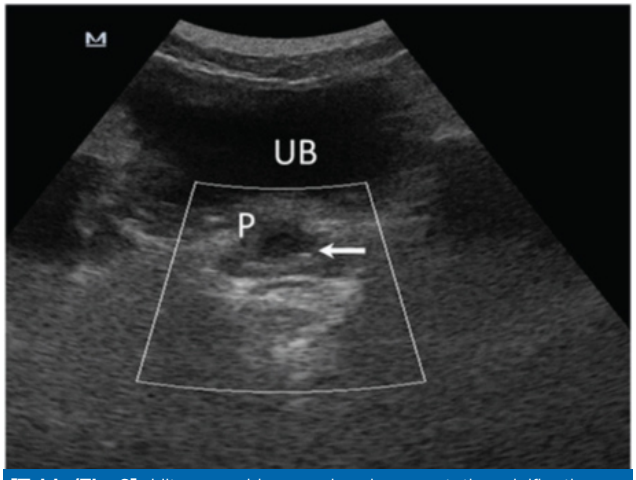
Micro calcifications in lumen of prostatic glands have been reported in prostatic carcinoma as well as in pre cancerous conditions [8, 9]. Laminated calcifications are characteristics of Basal cell hyperplasia [9]. Micro nodule of calcification in collagen environment suggests mucin secreting prostatic carcinoma [10].

Imaging Appearance

Plain Radiographs will show them only when they are sufficiently large or radio-opaque as radio-opacities in the expected locations of these organs. They are readily visible on ultrasound scan- the most widely used imaging modality; and are seen as hyperechoic foci with or without posterior acoustic shadowing [Table/Fig-2].

They can also be detected on Computerized Tomography (CT-scan) or Magnetic Resonance Imaging (MRI-scans). On CT-scan the calcifications appear as tiny hyperdense foci [Table/Fig-3] having CT density value +90 to +150 H.U.

MRI demonstrates them as hypointense foci on all MRI sequences, seen best on gradient echo sequence.



[Table/Fig-2]: Ultrasound image showing prostatic calcification as hyperechoic focus without posterior acoustic shadowing.

[Table/Fig-3]: Plain CT-scan showing prostatic calcifications as tiny hyperdense foci having CT density value +90 to +150 H.U.

Health Impacts of Calcification

Thus, the calcifications of prostate could either be innocuous and incidental or might well be a harbinger or hall mark of benign or neoplastic process.

Irrespective of their etiology, they can be seen on routine Pelvic or Transrectal ultrasound as hyperechoic foci with posterior acoustic shadowing.

Prostatic calcifications are thought to be associated with Chronic Prostitis and Chronic Pelvic Pain syndrome in males [4]. These conditions can have adverse effects on sexual activity as it is found to be associated with decreased sexual desire and erectile dysfunctions. Subjective abdominal symptoms like diarrhea and or constipation are also seen to be associated with as are subjective urinary functions like frequency, urgency and burning micturation.

CONCLUSION

With advances in imaging techniques, as prostatic calcifications are being increasingly detected; it is pertinent to know that large well formed calcifications suggest benign pathology. Micro calcifications, on the other hand suggest pre cancerous or even cancerous prostatic lesion.

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