Purpose:
A metallic instrument usually has much higher acoustic impedance than the surrounding tissue. Thus the reflections from instrument appear as high intensity pixels in the ultrasound image. Acoustic shadows, attenuation and other artifacts can also locally obscure the continuous appearance of the instrument. Moreover, specific instrument such as a needle with hole inside used in prostate brachytherapy, can generate strong reverberation artifacts. The reverberation artifacts stemmed from metal interference adversely affect the ultrasound image quality and lead to erroneous placement of needle. Reduction of artifacts will improve signal-to-noise ratio and the quality of seed implant in prostate brachytherapy.

Methods:
In this work, we present an algorithm that adaptively applies automatic time-gain compensation (ATGC) and Reverberation Artifacts Elimination (RAE) strategies to correct the metal artifacts of needles in the proximity of region of interest during implant procedure. This algorithm includes five steps: 1. Use our automatic needle tracking algorithm to estimate the needle position; 2. A RAE filter is generated through an optimization procedure rendering a filter with an appropriate frequency response as well as good locality properties; 3. An ATGC filter is also generated through comparisons of intensity histgram in the region below the estimated needle position before and after needle insertion; 4. Estimate the new needle position from the corrected images; 5. Repeat from step 2 until the difference between two iterations is less than a threshold.

Results:
The ATGC and RAE strategies are used to correct ten 2D ultrasound images of prostate phantom with 19 needles. The needle tracking algorithm applies on the images before and after the correction.

Conclusions:
The variance in spatial geometry of needles before and after implementing ATGC and RAE strategies addresses the magnitude of improvement in signal-to-noise ratio and the quality of needle tracking.