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Lateral Flow Test for Presence and Susceptibility of Group B Streptococcus

Group B Streptococcus (GBS) is a pathogenic bacterium that is known to cause mortality in infants. Vertical transmission of GBS from mother to newborn can lead to an infection with a high mortality rate. Therefore, sensitive and specific detection of the pathogen is essential for prescription of prophylaxis during delivery. GBS colonization occurs in as many as 40% of pregnant women and is routinely detected with culture-based methods, which require at least 48 hours for full identification. While the CDC recommends routine GBS screening at 35 to 37 weeks of pregnancy, a shorter turnaround time is essential in the event of an emergency delivery. Another emerging concern is that the widespread use of intrapartum antibiotic prophylaxis has resulted in development of antibiotic resistance in GBS isolates. While GBS is still susceptible to penicillin, ampicillin, and first-generation cephalosporins there is an increasing incidence of resistance to clindamycin and erythromycin. This makes susceptibility testing crucial in order to select the appropriate prophylaxis antibiotic for penicillin-allergic women because the most common agent used for this population is clindamycin. Furthermore, there is a need for improvement of current susceptibility testing methods because inducible clindamycin resistance can occur in strains that appear susceptible in broth tests. An easy-to-implement, accurate, and fast diagnostic for GBS with susceptibility-testing capabilities would make the process of prophylaxis antibiotic selection straightforward and decrease unnecessary antibiotic use. The goal of this project will be to create a lateral flow assay that can be used on a vaginal swab sample in order to detect the presence of GBS as well as clindamycin/erythromycin resistance genes. The detection approach used three tools: peptide nucleic acid (PNA) technology for specific sequence recognition within the pathogen's genomic DNA, amplification of the target sequence with isothermal rolling circle amplification (RCA), and lateral flow-based detection using streptavidin covered gold nanoparticles and a streptavidin binding DNA aptamer. The use of gold nanoparticles and lateral flow strips makes this a visual detection that can be performed on site at the point-of-care. Major advantages of this approach are compact design, simplicity of use, low manufacturing cost, and speed.