Consider a grade 2 perfect ideal $I$ in $R = k[x_1, \ldots, x_d]$ which is generated by forms of the same degree. Assume that the presentation matrix $\varphi$ is almost linear, that is, all but the last column of $\varphi$ consist of entries which are linear. For such ideals, we find explicit forms of the defining ideal of the Rees algebra $R(I)$. We also introduce the notion of iterated Jacobian duals and present properties such as Cohen-Macaulayness, regularity, relation type of the Rees algebra of ideals whose second analytic deviation is one. (Received August 08, 2015)